



COLONY OF MAURITIUS

DEPARTMENT OF AGRICULTURE

Seventeenth Annual Report
of the
Sugarcane Research Station
1946

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SUGARCANE RESEARCH STATION, MAURITIUS
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STAFF

<i>Senior Chemist, Officer-in-Charge</i>	...	...	...	...	N. CRAIG, M.S.C. (Durham).
<i>Botanist</i>	...	...	...	...	H. EVANS, PH. D. (Wales).
<i>Geneticist</i>	...	...	...	...	G. C. STEVENSON, B.A. (Cantab.), A. I. C. T. A.
<i>Assistant Chemist</i>	...	...	...	...	P. HALAIS, DIP. AGRIC. (MAUR).
do <i>Botanist</i>	...	...	...	...	S. M. FEILLAFÉ, DIP. AGRIC. (MAUR)., (acting).
do <i>Geneticist</i>	...	...	...	...	G. MAZERY, DIP. AGRIC. (MAUR).
<i>Field Officer in charge of Cultural Methods</i>	...	...	...	...	J. MAROT.
<i>Temporary Assistant for Cultivation and Manurial Experiments</i>	...	...	...	...	M. SOOLTANGOS, DIP. AGRIC. (MAUR).
<i>Clerical Assistant (part-time services only)</i>	...	...	...	...	R. S. BUGUTH.

RESEARCH ADVISORY COMMITTEE OF THE SUGARCANE RESEARCH STATION FOR THE YEAR 1946

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Mr. P. de Sornay, Chevalier de la Légion d'Honneur.

Seventeenth Annual Report of the Sugarcane Research Station for the Year 1946

Introduction

In contrast with the previous year, growth conditions during 1946 were satisfactory, rainfall well distributed and temperature generally above normal. Rainfall during the last three months of 1945 was somewhat above the average, so that the 1946 crop had a good start, and a threatened drought in January 1946 was broken by the cyclone of February, and from then up to May rain was well distributed and sufficient in quantity. After a very dry June, precipitation in July and August was again above average, and this combined with temperatures nearly 1°C above the normal resulted in delaying maturity of the crop. October was an abnormally dry month, but in November the rainfall amounted to between three and four times the average, so that any standing canes started growing again with the result that extraction was lowered to an appreciable degree. In view of the expected heavy cane tonnages to be handled, combined with shortage of labour, the crop period extended over an abnormally long period, from early July to the end of December, but in spite of this, the extraction rate reached 11·5 per cent., a figure which in view of conditions prevailing must be regarded as satisfactory. Cane tonnages were lower than expected, and this may be due to (a) cyclone damage, particularly in the South-West portion of the island and (b) the high percentage of arrowing canes in many districts. As all the fields containing a high proportion of arrowed canes could not be harvested early in the crop season, there was a progressive loss of cane due to drying out.

Rainfall figures for three stations and temperature figures for Reduit, supplied by the Statistician, Department of Agriculture, are as follows—

		Pamplemousses Experiment Station		Central Experiment Station, Réduit		Royal College, Curepipe		
1946 Months		Rainfall		Rainfall		Temperature above (+) or below (--) normal °C	Rainfall	
		Average Inches	1946 Inches	Average Inches	1946 Inches		Average Inches	1946 Inches
January ...	...	9·56	5·17	10·32	4·07	0·0	16·33	26·43
February ...	...	8·74	8·25	10·95	17·19	+0·1	17·28	10·82
March ...	...	9·32	7·49	11·94	9·88	+0·2	19·31	23·83
April ...	...	5·96	8·60	5·41	9·49	+0·2	12·39	27·08
May ...	...	4·48	5·18	4·24	4·88	+0·2	9·86	13·16
June ...	...	3·43	0·27	3·11	1·07	+0·4	7·47	8·80
July ...	...	2·93	3·15	2·75	5·10	+0·9	8·57	8·80
August ...	...	2·59	3·17	2·47	2·13	+0·7	7·79	11·07
September ...	...	1·83	1·15	1·71	1·25	-0·3	5·78	5·84
October ...	...	1·95	0·38	1·91	0·39	+1·1	4·52	1·33
November ...	...	2·13	7·75	2·33	8·60	+0·4	5·71	12·56
December ...	...	4·91	1·60	6·37	5·75	+0·3	9·71	8·26
TOTAL	...	57·83	52·16	63·51	69·80	—	124·72	157·98

Although no census of cane varieties was done during the year, it can be confidently stated that most of the new plantations were made with varieties produced by the Sugarcane Research Station, M.134/32 still remaining the most popular. In certain conditions, however, the variety M.112/34 has outyielded the M.134/32, due probably to the excellent growing season. The newly released varieties M.165/38, M.63/39 and M.76/39 have been distributed to many estates and planters, but the factory qualities will not be known until after the 1947 crop at the earliest.

The six new varieties of sugarcane B.3337, B.3439, B.34104, B.37161, B.37172 and B.4098, received from Trinidad, B.W.I., have been grown through two generations in the quarantine greenhouse, and have now been planted out in observation plots on the experimental station. Rapid methods of propagation are being employed, in order to obtain sufficient planting material as early as possible to plant a number of field trials with them. It is also hoped that a few arrows may become available in the coming crossing season, to extend the scope of our breeding work.

The research work of the Station was on a much more extended scale than it had been for a number of years and it approached the pre-war level. The Officer in charge of the Station returned to the Colony on 3rd January, 1946, and the Botanist resumed duty on 6th May, 1946. Mr. Stevenson, the Geneticist left the Colony on 5th April, 1946, after almost eight years' continuous service in the Colony, and had not returned by the end of the year. Mr. E. M. d'Unienville, who had been appointed Field Assistant in charge of Cultural Methods, resigned this appointment to take up duties with the Mauritius Agricultural Bank, and I would like to take this opportunity of expressing my gratitude to him for his constant support during our all too short association. Mr. J. Marot, formerly Acting Agricultural Instructor in the Agricultural Division, was appointed to replace Mr. d'Unienville on 1st August, 1946.

A number of posts—Field Demonstrators—have been authorized, but up to the end of the year no appointments had been made. The object of these new posts is to improve the yields of small planters' canes, by demonstrating the effect of better cultural and fertilizer practices, and by introducing new varieties of canes as soon as possible.

A new experimental station has been started at Côte d'Or Sugar Estate. The climatic conditions obtaining in this locality are representative of the cooler and more humid parts of the highlands; the soil is of the highly laterised, mature type, and it is not expected to be in a high state of fertility, as part of it was under the variety Co. 301, and the remainder was abandoned. The creation of this Station should

result in greater efficiency in the selection of cane varieties specially suited for the wet cold regions of the island. Up to the present, both stations used for selection work have been in low rainfall areas, where irrigation is necessary to grow satisfactory crops. The planting out of seedlings has already started, between 3,000 and 4,000 having been placed out in the field by the end of the year. These seedlings will only be selected in 1948, and it is hoped in this way to obtain some long season canes suitable for the high and medium rainfall districts.

With the return of the Botanist, the research work of the Botanical Division has been greatly extended; the chief lines of research conducted being (a) the use of weed-killers (b) the effect of organo-mercurial compounds on cane cuttings and (c) an investigation into the metabolism of the cane throughout the growth period.

In the Chemical Division, work has again been concentrated on Foliar Diagnosis, particularly in conjunction with field experiments conducted on Estates. During the crop, nineteen $3 \times 3 \times 3$ N.P.K. experiments, seventeen in virgins and two in first ratoons, were harvested and all these were used for foliar diagnostic studies.

The Research Advisory Committee of the Station met on 1st August, 1946, to discuss the Annual Report for 1945 and suggestions for future research. Questions connected with the status of the officers of the Station were also discussed.

The Officer in charge of the Station acted as Assistant to the Director of Agriculture from the time of his return from leave. On the departure of the Government Tobacco Officer on leave on 15th April, 1946, he was also responsible, with the Director of Agriculture, for the supervision of the work at the Tobacco Research Station. The British Government has granted a bonus for replanting in sugarcane, lands diverted to food stuffs during the war, and in connection with the payment, as large a number of test checks as possible must be made. The Officer in charge has been in charge of organizing the inspectorate to carry out these test checks.

During the year, a very large number of experiments were conducted on estates, and it is with great pleasure that I acknowledge the very real help which all members of the Staff received from managers of estates and members of the planting community in general. In spite of the heavy cane crop and shortage of labour all field experiments were harvested at the proper time, and subsequent work such as application of fertilizers, etc., was expeditiously performed. This indicates a very healthy and whole-hearted co-operation between planters and the scientific staff, and this co-operation can only be productive of beneficial results.

N. CRAIG,
Officer-in-charge,
Sugarcane Research Station,

PART I.—GENETICIST'S DIVISION

I. Cane Breeding—M./46 Series

Climatic conditions have been exceptionally favourable for arrowing and most of the promising crosses contemplated could be made. Most of the crosses were carried out at the Central Experiment Station, only few crosses being made at the Pamplémousses Experiment Station. The large number of seedlings obtained provided an ample supply of planting material for the first year trials at the above stations as well as at the new Experiment Station in the upper Plaines Wilhems district.

A summary of the breeding work is given in Table I.

TABLE I.

	No. of crosses made	No. of lanterns used	No. of seedlings obtained	No. of seedlings planted		
				C.E.S.	P.E.S.	P.W.E.S.
1. Nobilization of <i>S. spontaneum</i> (Java):						
(a) 3rd nobilization	1	1	6	5	—	—
(b) 4th ,, 	14	14	1,810	495	167	653
(c) 5th ,, 	21	21	10,361	2,076	1,110	2,084
(d) mixed "glagah" crosses ...	4	4	66	3	—	—
2. Nobilization of <i>S. spontaneum</i> (India):						
(a) 2nd Nobilization 	1	1	425	—	—	257
(b) 3rd ,, 	1	1	4	4	—	—
3. Nobilization of <i>S. barberi</i> -						
(a) Mixed barberi crosses	1	1	50	—	—	48
4. Crosses involving several <i>Saccharum</i> spp—						
(a) <i>S. officinarum</i> , <i>S. spontaneum</i> (Java), <i>S. spontaneum</i> (India)	63	63	11,331	3,543	2,239	1,403
(b) <i>S. officinarum</i> , <i>S. spontaneum</i> (Java), <i>S. barberi</i>	3	3	211	143	—	—
(c) <i>S. officinarum</i> , <i>S. spontaneum</i> (Java), <i>S. spontaneum</i> (India), <i>S. robustum</i>	3	3	268	136	—	—
(d) <i>S. officinarum</i> , <i>S. spontaneum</i> (Java), <i>S. spontaneum</i> (India) <i>S. barberi</i>	10	10	—	914	2,271	506
(e) <i>S. officinarum</i> , <i>S. spontaneum</i> (India), <i>S. robustum</i>	1	1	10	9	—	—
TOTALS 	123	123	24,542	7,328	5,787	4,951

As many crosses as possible have been made of the types 4 (*a*) and 4 (*d*) above, these crosses having proved to be the most promising ones tried in the progeny test with 1944 seedlings.

The usual breeding methods have been followed. For the first time seedlings have been planted at the new Experiment Station situated in the upper wet district of the island. The seedlings tested there were transferred in the pot stage from the Central Experiment Station and planted immediately in the field. This method has proved quite satisfactory. Experience however has to be gained with regard to the best season for planting seedlings in this locality.

Special randomized blocks of the same layout as those planted in 1944 and 1945 have been established at each of the three experiment stations in order to study the performance of various crosses under different climatic conditions.

II. First Year Trials

(*a*) *Virgins*.—*M./45 Series*. The favourable climatic conditions which prevailed during the growing season have rendered possible the selection of seedlings from the virgin crop at the Central Experiment Station as well as at the Pamplémousses Experiment Station. At the former station 143 seedlings were selected from a population of 5,920 seedlings or approximately 2·4 per cent. while at the latter station 42 were selected out of a population of 2,735 seedlings or approximately 1·5 per cent.

(*b*) *Ratoons*.—*M./44 Series*. At Réduit 84 seedlings have been selected from the ratoon crop of this series which comprised a total population of 8,482 seedlings or approximately 1 per cent. At Pamplémousses the corresponding figures were 74 out of 4,965 or approximately 1·5 per cent.

The results obtained with crosses tested in the special randomized plots in 1944 and in 1945 are given in Tables II, III and IV.

TABLE II

1944 SEEDLINGS—PAMPLEMOUSES EXPERIMENT STATION

Virgin Crop—examined 5.11.1945

Ratoon Crop—examined 22. 8.1946

					Weight (Kgs.)		Cane Number		Ref. Brix	
					Mean		Mean		Mean	
					Mean	V*	Mean	V	Mean	V
Co. 281 × M. 63/39	...	...	Virgin Crop	...	8.23 ± 0.51	59.5	10.50 ± 0.52	47.6	21.38 ± 0.10	4.6
	...	...	Ratoon	...	13.20 ± 0.64	44.9	12.80 ± 0.76	56.3	18.03 ± 0.25	13.0
M. 112/34 × M. 99/34	...	...	{ Virgin	...	7.53 ± 0.32	42.1	7.88 ± 0.26	32.4	21.14 ± 0.13	6.1
	...	...	{ Ratoon	...	13.30 ± 0.55	40.7	9.50 ± 0.44	45.5	17.27 ± 0.77	9.4
M. 134/32 × M. 341/40	...	...	{ Virgin	...	5.95 ± 0.28	47.2	8.66 ± 0.38	43.2	20.81 ± 0.15	7.3
	...	...	{ Ratoon	...	9.70 ± 0.58	56.8	10.10 ± 0.57	54.3	16.94 ± 0.24	13.5
M. 112/34 × M. 76/39	...	...	{ Virgin	...	5.83 ± 0.23	39.8	7.03 ± 0.24	33.6	21.75 ± 0.10	4.5
	...	...	{ Ratoon	...	9.30 ± 0.46	48.3	6.80 ± 0.53	47.1	17.70 ± 0.18	10.0
M. 134/32 Clonal ...	...	...	{ Virgin	...	5.31 ± 0.21	39.9	6.35 ± 0.19	29.4	21.91 ± 0.14	6.5
	...	...	{ Ratoon	...	11.60 ± 0.43	36.8	8.70 ± 0.28	31.8	19.03 ± 0.08	4.4
Co. 281 × P.O.J. 2878	...	...	{ Virgin	...	4.55 ± 0.32	64.8	7.2 ± 0.42	51.3	22.19 ± 0.27	11.3
	...	...	{ Ratoon	...	8.30 ± 0.65	65.1	8.60 ± 0.55	55.6	18.78 ± 0.13	6.0
M. 112/34 × M. 27/16	...	...	{ Virgin	...	4.29 ± 0.23	51.5	5.69 ± 0.26	44.1	21.80 ± 0.14	6.5
	...	...	{ Ratoon	...	7.30 ± 0.40	51.1	6.20 ± 0.34	52.0	17.20 ± 0.17	9.1
M. 144/42 × M. 27/16	...	...	{ Virgin	...	3.38 ± 0.20	57.4	5.48 ± 0.28	49.3	21.20 ± 0.08	3.7
	...	...	{ Ratoon	...	5.00 ± 0.36	65.6	5.10 ± 0.36	66.7	16.93 ± 0.21	10.9
M. 112/34 × M. 72/31	...	...	{ Virgin	...	3.38 ± 0.19	53.8	5.08 ± 0.24	45.5	22.32 ± 0.15	6.5
	...	...	{ Ratoon	...	5.80 ± 0.51	77.2	5.30 ± 0.39	67.5	17.25 ± 0.14	6.9
55P × P.O.J. 2878	...	...	{ Virgin	...	2.31 ± 0.18	58.0	3.91 ± 0.25	48.6	21.39 ± 0.16	5.8
	...	...	{ Ratoon	...	4.40 ± 0.47	67.5	3.20 ± 0.26	62.2	17.01 ± 0.30	10.9
Mean for Virgin Crop	...	...				52.4		42.5		6.28
Mean for Ratoon Crop	...	...				55.4		53.9		9.41

*V = Coefficient of variability.

In this table the results obtained with both virgin and ratoon crops have been tabulated for direct comparison.

(i) It will be observed from this table that the average variability in the weight per stool and Brix has increased in the ratoon crop as compared with the virgin, while in the case of M. 134/32 (clonal) there is a decrease in variability. These facts tend to indicate that the selection from the ratoon crop is better than in virgins. These figures bear out those already obtained from other seedling populations in 1942 (*Vide Revue Agricole*, May-June 1943).

(ii) The comparatively high value of the coefficient of variability in the weight and Brix for M. 134/32 in both virgin and ratoon crops shows the influence of environmental conditions and goes to prove that selection standards should not be too high at the seedling stage. In other words the percentage of seedlings selected from the progeny plots should be as high as is reasonably possible.

(iii) It will be remarked that in the ratoon crop the mean weight is much higher than in the virgin crop and the Brix lower. This is due to the fact that during the year under review climatic conditions have been exceptionally favourable to growth and rather unfavourable to the ripening process.

TABLE III
1945 SEEDLINGS—PAMPLEMOUSES EXPERIMENT STATION

	(Virgin Crop)										Ref. Brix									
	Weight (Kgs).					Cane Number					Frequency %					Frequency %				
	Mean	Frequency of Stools %					Mean	Less than 8	8-11	12-15	16-19	20-24	Mean	Below 20	20-9	21-9	22-9	23-9	23-9	23-9
M. 112/34 × M. 99/34 ...	11.4	Below 5 kgs. 7	5 to 9.9	10 to 14.9	15 to 19.9	20 to 24	9.0	36	45	16	3	0	20.4	29	42	23	4	2		
P. O. J. 2878 × M. 99/34...	10.6	5	34	39	18	4	10.1	23	50	24	2	1	20.7	24	30	35	10	1		
M. 112/34 Standard ...	7.8	17	60	23	0	0	7.3	67	31	2	0	0	21.8	0	15	43	38	2		
M. 2/33 × M. 243/40 ...	6.2	37	53	8	2	0	7.0	62	34	4	0	0	19.8	51	33	13	3	0		
M. 112/34 × D. 109 ...	6.0	45	40	15	0	0	7.0	65	31	4	0	0	20.5	35	27	22	12	4		
M. 134/32 Standard ...	5.7	40	56	4	0	0	6.2	88	12	0	0	0	20.5	26	35	33	6	0		

TABLE IV
1944 SEEDLINGS—CENTRAL EXPERIMENT STATION

	(Ratoon Crop)										Ref. Brix									
	Weight (kgs).					Cane Number					Frequency %					Frequency %				
	Mean	Below 10 kg.	10-14.9	15-19.9	20-24.9	25-30.9	Mean	Below 8	8-11	12-15	16-19	20-23	Mean	Below 19.0	19-9	20-9	21-9	22-9	23-9	23-9
M. 134/32 ...	16.2	16	33	25	12	2	9.6	30	50	17	3	—	19.89	20	31	33	15	1		
M. 112/34 × M. 76/39 ...	12.3	36	40	13	7	2	8.6	42	41	14	3	—	20.57	11	28	20	27	11	3	
M. 134/32 × M. 27/16 ...	11.4	42	31	19	6	2	9.0	42	36	18	4	—	19.70	34	25	22	13	5		
M. 134/32 × M. 23/16 ...	11.3	44	35	12	7	2	8.4	50	32	14	3	1	20.19	26	26	23	16	7	2	
M. 112/34 × M. 27/16 ...	7.4	62	27	7	4	—	7.4	65	27	6	2	—	20.15	20	22	21	25	9	3	
M. 112/34 × M. 196/31 ...	8.7	62	22	11	2	3	7.4	63	20	10	6	1	19.05	38	20	25	11	3	3	
55P × P. O. J. 2878 ...	6.6	78	17	3	2	—	6.6	66	27	7	—	—	20.18	20	33	13	15	18	1	
M. 20/16 × P. O. J. 2878...	6.6	77	20	3	—	—	4.9	90	10	—	—	—	20.07	24	20	29	15	9	2	
B. 11569 × M. 13/18 ...	6.4	82	9	8	1	—	5.4	85	11	4	—	—	19.90	22	28	27	21	1	1	
M. 20/16 × M. 72/31 ...	6.0	86	11	2	1	—	4.6	89	11	—	—	—	19.65	43	13	19	14	7	4	

(iv) Tables III and IV give the figures obtained from the randomized blocks planted at Pamplémousses Experiment Station and Central Experiment Station respectively and include four of the crosses already tested in the 1944 series together with nine other crosses, the standards being M. 134/32 and M. 112/34 (clonal). In these tables the results have been worked out in a different manner in order to render the interpretation easier. The figures given show the average weight, average cane number, average Brix and frequency of the seedlings in each group as indicated. In this way it is possible at a glance to have an idea of the variability of the standards and to assess the relative value of the crosses. The larger the frequency of the stools in the higher groups for Brix and weight, the better the crosses, irrespective of the mean.

(v) The comparatively high variability of M. 134/32 as observed in these trials tends to support the views expressed in paragraph (ii) above, that is that selection standards should not be high.

III. Second Year Trials

Forty-seven varieties of the M./42 series have been planted in second trials in February at Réduit. All these varieties were originally selected from ratoons. At Pamplémousses five trials were planted in June, which comprised thirty-nine varieties of the M./43 ratoon selections.

Eleven second year trials were reaped during the year at the Central Experiment Station. All included the M./41 seedlings selected from ratoons. Twenty-eight varieties have been retained for further trial. At Pamplémousses thirteen trials were harvested during the crop. Seven of these were first ratoons and had already been harvested in virgins in 1945; three varieties of the M./41 series which had not been selected in virgin crop were retained for further trial.

Seven varieties of the M./42 series - ratoon selections—and six of the M./43 series—virgin selections—have also been retained from the other trials.

IV. Third Year Trials

At Pamplémousses two trials were cut in ratoons and three in virgins. The five varieties which had been selected from the first two trials in 1945 were again better than the standards although not significantly so. Two varieties of the M./40 series and three of the M./41 series were selected from the three trials reaped in virgin crop.

One trial has been planted at Réduit in order to test six varieties of M./40 series. At Pamplémousses two trials have been planted in July–August; seven varieties of the M./41 series and six of the M./42 series are being tested in these trials.

V. Variety Trials

Ten of the most promising varieties produced by Ebene Sugar Estate, as indicated by the Estate Manager, have been planted in a special field trial at the Central Experiment Station. No comparative figures are yet available for these varieties and it is only after such figures are obtained that permission for planting these varieties on a commercial scale will be considered.

During the year under review nine trials have been planted on estates in order to study under different climatic conditions the performance of the new varieties selected from third trials at the Experiment Stations.

All variety trials reaped on estates comprised two or three varieties released in 1945. Ratoons as well as virgins have had a normal growth cycle and climatic conditions have been rather favourable. Consequently the results given in table V should give a fair idea of the value of these canes.

TABLE V

	M. 165/38.			M. 63/69.			M. 76/39.		
	Tons cane per arpent	Sucrose % Cane	Tons sucrose per arpent	Tons cane per arpent	Sucrose % Cane	Tons sucrose per arpent	Tons cane per arpent	Sucrose % Cane	Tons sucrose per arpent
Pamplémousses Experi- ment Station *	...	...	...	...	...	...	...	...	...
Constance †	+ 2.5 ± 5.4	- 2.99	- 0.74 ± 0.72	+ 1.6 ± 5.4	- 0.88	- 0.09 ± 0.72	- 4.0 ± 5.4	- 0.72	- 0.81 ± 0.72
Rich Fund †	+ 16.5 ± 6.2	+ 0.04	+ 2.3 ± 0.86	± 12.2 ± 6.2	+ 0.01	+ 1.69 ± 0.86	+ 12.5 ± 6.2	+ 0.42	+ 1.94 ± 0.86
Valetta †	- 8.6 ± 8.5	- 2.37	- 2.23 ± 1.07	+ 2.4 ± 8.5	- 2.52	- 1.01 ± 1.07	- 5.5 ± 8.5	- 1.37	- 1.41 ± 1.07
Alma †	- 0.1 ± 4.7	- 2.64	- 0.56 ± 0.63	+ 8.8 ± 4.7	- 3.10	+ 0.45 ± 0.63	+ 0.8 ± 4.7	- 2.36	- 0.48 ± 0.63
Mon Désert †	—	—	—	+ 7.9 ± 6.7	- 0.74	+ 0.84 ± 0.94	+ 0.7 ± 6.7	+ 0.31	+ 0.19 ± 0.94
St. Antoine †	+ 17.3 ± 7.9	- 0.98	+ 2.11 ± 1.1	+ 14.6 ± 5.2	- 2.69	+ 0.57 ± 0.54	+ 2.5 ± 5.2	- 2.15	- 0.48 ± 0.54
Rose Belle †	+ 2.9 ± 4.5	- 1.75	- 0.07 ± 0.55	+ 6.1 ± 7.9	- 0.48	+ 0.87 ± 1.1	+ 4.8 ± 7.9	- 0.70	+ 1.02 ± 1.10
Pierrefonds †	+ 9.9 ± 10.9	3.08	+ 0.13 ± 1.3	+ 5.0 ± 4.5	- 1.70	+ 0.19 ± 0.55	+ 3.4 ± 4.5	- 1.93	- 0.06 ± 0.55
Riché en Eau †	+ 3.0 ± 7.3	- 0.13	+ 0.42 ± 1.00	+ 7.8 ± 10.9	- 1.88	+ 0.88 ± 1.3	+ 4.6 ± 10.9	- 1.29	- 1.32 ± 1.3
				0 ± 7.3	+ 0.29	+ 0.07 ± 1.00	- 4.6 ± 7.3	- 0.20	- 0.64 ± 1.00

* 2nd ratoons.

† 1st ratoons.

† virgins.

In each case the standard has been M. 134/32. The figures indicate the differences between the corresponding variety and the standard.

It will be seen from these results that although the individual figures are not always significant, the three varieties have given an appreciably better yield of cane than the standard. On the other hand, the sucrose content of the standard being definitely higher than that of the three other varieties, the differences in yield of sucrose per arpent are rather small. These results tend to show, however, that M. 63/39 is better than the two other released varieties. Field observations have also indicated that M. 63/39 seems to be suited to almost all climatic conditions in the island.

VI. Incidence of Diseases

The incidence of Red Rot on M. 134/32 was almost unnoticeable during this season ; this relieved the anxiety caused on some estates by the large percentage of diseased canes found in this variety last year.

The occurrence of chlorotic streak on M. 165/38, M. 63/39 and M. 76/39 was noticed in several variety trials and propagation plots on estates as well as on the Experiment Stations. However, although this disease is not considered as a very important one, under local conditions, the Plant Pathologist of the Department of Agriculture is carrying out investigations in this connection.

VII. Export of Fuzz

Fuzz from six crosses have been sent to the Director of the Experiment Station of the South African Sugar Association at Mount Edgecombe.

VIII. Imported West Indian Varieties

A second generation of the six imported West Indian varieties B. 3337, B. 3439, B. 4098, B. 34104, B. 37161 and B. 37172 has been planted in the quarantine greenhouse in April last. In December these canes were planted out in the field and, by using rapid propagation methods, about 150 stools of each variety have been obtained. It is hoped that enough planting material will be available in August 1947 for planting trials on the three experimental stations. Ten stools of each variety have also been planted in a special plot for breeding purposes.

G. MAZERY,
Acting Geneticist.

PART II—CHEMISTRY

Introduction

The division has been at full strength throughout the year, and good progress has been made with the research programme. It is very satisfying to be able to record that all manurial trials planted on estates were, with the exception of one which had been abandoned early in the year, reaped according to schedule, and subsequent cultural operations and fertilizer applications completed before the end of the year. It is necessary to emphasize that the primary object of these experiments is to enable more precise information to be obtained regarding foliar diagnostic methods of diagnosing plant food deficiencies in the soil which are reflected in the plant itself rather than to try to formulate fertilizer programmes for the different localities, based on the results obtained at harvest. Although the soils in a given area may be genetically similar, yet due to differences in cultural methods over a long period the status of the soils with respect to plant foods may be very different. Consequently although the results of any field trial may be applicable to soils in close proximity to the experiment, it is necessary to have some other method to enable recommendations to be made to suit particular conditions. The method of foliar diagnosis as practised here is a suitable method by which this can be done. The cane plant itself "analyses" the soil, and the chemist in his laboratory analyses a definite portion of the cane plant in order to get an index showing whether the soil is deficient in a particular plant food or not. A definite quantitative answer cannot be obtained, but the divergence from the optimum of any particular sample will indicate whether the lack of the plant nutrient is serious or not.

Fertilizer Trials on Estates

Eighteen fertilizer trials, sixteen of them being in virgin canes and two in first ratoons, were conducted on a 3N x 3P x 3K factorial design, with one replication in each trial. The quantities of fertilizer applied in these trials were approximately the same throughout, and the average age at harvest was 15 months for the virgin trials and 12 months for the ratoon trials. In addition, a nitrogen trial conducted on a randomized block layout including four levels of nitrogen and replicated four times was also harvested. In all these trials, the variety under test was M. 134/32, a cane variety which is now supreme in the colony. The quantities of nitrogen, phosphoric oxide and potash applied to the different plots of the factorial trials in virgin canes is shown below, in kilos per arpent.

		0	1	2
N	...	0	34	68
P ₂ O ₅	...	0	30	60
K ₂ O	...	0	35	70

In all the trials, the leaves were sampled when the canes were about 8–10 months old, during the season of maximum growth, by the method recommended by this Station. Thirty leaves of the third rank were taken from each plot, and weighed in the fresh state. Sub-samples were then taken by the leaf punch technique, and these sub-samples were then oven-dried and kept for subsequent analyses. At harvest, composite samples for each level of nitrogen, phosphorus and potash were taken, and analysed for sucrose, juice purity, etc. In addition, one plot was selected in each experiment wherein from a consideration of average weight of leaf of the third rank it was considered that the highest yield would be obtained at the lowest level of fertilizer. In other words, for selecting the best plots, each element was considered individually, and when a big response was indicated, the highest level for that element was taken, whereas for a medium response, the middle level was taken and for no response the lowest level. Thus if there were a big response to nitrogen, no response to phosphate and a medium response to potash, the plot selected would be the 2:0:1 level plot. From these plots at the time of harvest, a certain area (10 feet) was cut, and the millable cane, whole green tops, and trash were weighed in order to establish the ratio between these different portions. Samples of the three portions were also taken for subsequent analysis, to determine the composition of the whole aerial portion of the cane plant growing in conditions where there was neither lack nor excess of fertilizer elements.

Complete results of these sixteen trials in virgin canes are not presented, but only those results showing the main effects, e.g., comparison between plots receiving no nitrogen, 34 kilos and 68 kilos of nitrogen per arpent. Yields are expressed as a percentage of the mean for the plots having received none of the element under discussion. The results are given in Table I, (p. 15) which also gives the Index of Vegetative Growth.

Although it is not intended to discuss the results of individual trials, some general trends may be noted, but it is first necessary to point out that these trials were conducted on lands where good cultural practices had been followed for a number of years and consequently results of a very different character might have been observed on the poorer lands. However under these estate conditions, it may be seen that the application of nitrogen generally results in an increased crop, but that the increase amounts to about 12 per cent. or between 3 and 4 tons per arpent. The biggest increases however are generally found, as might be expected, when no pen manure is used. The responses to phosphatic and potash fertilizers is less pronounced, and the number of trials in which any response is obtained is smaller than in the case of nitrogen.

The average results of the sixteen virgin trials of M.134/32 harvested in 1946 given in Table III (p. 16) indicate the level of response which may be expected from fertilizer applications to virgin canes under estate conditions.

In the case of ratoon canes, however, the increased yield following applications of nitrogenous fertilizers is considerably higher than in virgin canes, as is shown in Table II (p. 16).

TABLE I

TABULATED RESULTS OF EIGHTEEN TRIALS (a) IN VIRGIN CANES AND TWO IN FIRST RATOON CANES

Name of Estate	No. of Trial	Category	Comparative Yield of Millable Cane									Index of Vegetative Growth								
			Nitrogen (N)			Phosphoric acid (P ₂ O ₅)			Potash (K ₂ O)			Nitrogen (N)			Phosphoric acid (P ₂ O ₅)			Potash (K ₂ O)		
			0 (b)	1	2	0 (b)	1	2	0 (b)	1	2	0 (c)	1	2	0 (c)	1	2	0 (c)	1	2
			0 (b)	1	2	0 (b)	1	2	0 (b)	1	2	0 (c)	1	2	0 (c)	1	2	0 (c)	1	2
Solitude S.E. ...	T 1/44	Virgins ...	100 (20'3)	104	102	100 (20'9)	97	101	100 (20'0)	105	107	100 (541'0)	106	108	100 (572'2)	97	100	100 (567'0)	99	101
" ...	T 1/44	1st Ratoons ...	100 (33'7)	105	117	100 (37'8)	90	97	100 (34'4)	104	110	100 (688'9)	115	121	100 (770'0)	101	99	100 (769'5)	100	106
Bon Espoir S.E. ...	T 2/44	Virgins ...	100 (18'5)	109	111	100 (19'7)	106	96	100 (19'4)	101	106	100 (611'5)	112	114	100 (653'4)	102	103	100 (664'8)	99	100
" ...	T 2/44	1st Ratoons ...	100 (24'2)	135	146	100 (31'1)	97	100	100 (30'3)	100	105	100 (665'7)	135	140	100 (821'5)	102	102	100 (816'7)	101	104
Britannia S.E. (d) ...	T 1/45	Virgins ...	100 (50'2)	102	103	100 (49'5)	101	108	100 (51'7)	101	95	100 (792'8)	107	118	100 (770'7)	115	119	100 (835'0)	105	103
Bénarès S.E. ...	T 2/45	" ...	100 (43'5)	105	102	100 (45'2)	102	93	100 (44'9)	101	97	100 (789'4)	101	104	100 (793'0)	102	102	100 (798'6)	102	100
Savinia S.E. ...	T 3/45	" ...	100 (39'1)	110	108	100 (41'4)	101	99	100 (40'3)	104	104	100 (709'4)	114	125	100 (788'3)	100	105	100 (792'5)	101	102
Riche-en-Eau S.E. (d) ...	T 5/45	" ...	100 (23'7)	135	141	100 (30'4)	98	95	100 (27'8)	105	115	100 (547'5)	117	118	100 (575'1)	109	110	100 (552'7)	115	117
Beau Vallon S.E. (d) ...	T 6/45	" ...	100 (35'3)	111	123	100 (40'7)	99	92	100 (37'0)	110	109	100 (659'5)	111	118	100 (726'0)	100	99	100 (714'5)	101	102
Constance S.E. ...	T 7/45	" ...	100 (35'2)	109	107	100 (39'1)	87	97	100 (36'7)	96	107	100 (787'4)	109	112	100 (824'0)	105	102	100 (835'2)	101	103
Union Flacq S.E. (d) ...	T 8/45	" ...	100 (37'8)	111	109	100 (39'1)	103	105	100 (39'3)	101	106	100 (583'3)	125	127	100 (656'9)	105	108	100 (664'5)	102	107
Savannah S.E. ...	T 9/45	" ...	100 (31'8)	124	114	100 (36'0)	98	100	100 (36'0)	105	96	100 (734'5)	112	122	100 (840'1)	97	95	100 (803'7)	102	103
Mon Songe S.E. ...	T 10/45	" ...	100 (33'7)	108	112	100 (39'2)	83	92	100 (37'4)	94	94	100 (747'9)	103	111	100 (819'1)	89	98	100 (785'0)	100	99
Mont Choisy S.E. ...	T 11/45	" ...	100 (34'3)	102	100	100 (34'4)	104	98	100 (34'7)	98	102	100 (692'3)	104	103	100 (696'6)	105	99	100 (694'4)	101	104
Pierrefonds S.E. ...	T 12/45	" ...	100 (22'8)	114	120	100 (27'2)	92	88	100 (25'6)	97	101	100 (536'9)	108	114	100 (625'8)	94	96	100 (606'4)	101	98
Rose Belle S.E. ...	T 13/45	" ...	100 (24'4)	100	102	100 (22'8)	105	119	100 (24'0)	108	100	100 (683'5)	117	125	100 (744'5)	107	107	100 (760'0)	103	104
Deep River S.E. ...	T 14/45	" ...	100 (20'1)	124	142	100 (24'2)	107	96	100 (24'7)	102	96	100 (612'5)	117	112	100 (687'9)	103	99	100 (691'3)	100	101
Réunion (Henrietta) (d) ...	T 15/45	" ...	100 (10'8)	124	114	100 (12'2)	108	91	100 (10'9)	112	123	100 (564'9)	108	103	100 (569'4)	106	103	100 (563'9)	106	106
Beau Champ S.E. (d) ...	T 16/45	" ...	100 (26'0)	122	135	100 (31'4)	93	103	100 (29'4)	102	113	100 (634'9)	108	108	100 (736'3)	99	99	100 (726'8)	97	104
Alma S.E. ...	T 17/45	" ...	100 (13'4)	128	115	100 (14'8)	102	110	100 (14'2)	104	120	100 (557'5)	113	109	100 (581'4)	103	105	100 (571'8)	103	110
General Average for Trials 1/45 to 17/45	Actual Yield	...	30'1	33'7	34'1	33'0	32'4	32'5	32'2	32'7	33'1	100	111	114	100	103	103	100	103	104
	Comparative Yield	...	100	112	113	100	98	98	100	102	103									

(a) Two of these were harvested in 1945, and are this year the two trials in 1st ratoon.

(b) The actual yield in tons cane per arpent represented by 100 is given in brackets.

(c) The actual weight of thirty leaves of third rank represented by 100 is given in brackets.

(d) These trials were planted without pen-manure, whilst the others received on an average 6 tons per arpent.

TABLE II

EFFECT OF NITROGEN IN RATOON CANES OF M. 134/32.

		Number	Comparative Yield of Millable Cane			Index of Vegetative Growth		
			Nitrogen			Nitrogen		
			0	1	2	0	1	2
Britannia	1942	1	100 (30.9)	104	98	100 (738.0)	106	109
Savinia	1942	1	100 (20.7)	113	116	100 (534.0)	117	137
St. André	1945	1	100 (18.0)	126	152	100 (453.0)	116	130
St. André	1946	1	100 (21.4)	131	165	100 (500.3)	127	151
Solitude	1946	T 1/44	100 (33.7)	105	116	100 (688.9)	114	120
Bon Espoir	1946	T 2/44	100 (24.2)	135	146	100 (665.7)	135	140
General Average in Tons Cane per Arpent			24.8	29.0	31.9	—	—	—
General Average—Index			100	117	129	100	119	130

TABLE III

AVERAGE RESULTS OF 16 VIRGIN TRIALS—M. 134/32—AVERAGE AGE 15 MONTHS

		0		1		2	
		Tons cane per arpent	Sugar	Tons cane per arpent	Sugar	Tons cane per arpent	Sugar
N	...	30.1	3.28	33.7	3.49	34.1	3.56
P ₂ O ₅	...	33.0	3.58	32.4	3.44	32.5	3.50
K ₂ O	...	32.2	3.44	32.7	3.46	33.1	3.59

The Index of Vegetative Growth

In earlier work on foliar diagnosis, it was evident that when the canes showed a big response to fertilizer applications the leaf samples consisting each of thirty leaves of third rank also reflected this response. Consequently the leaf samples were weighed in the fresh state to see if these weights could be used as an accurate index to forecast the effect of the fertilizers in manurial trials. Figures are presented in Tables I and II (pp.15-16), showing the comparative yield of millable cane and the index of vegetative growth in 22 experiments, sixteen in virgin canes and 6 in ratoon canes. If the general averages for these two sets of indices are compared, it will be seen that the two sets of figures agree to a surprising degree. For instance the yield for virgin trials in the 0, 1 and 2 levels of nitrogen plots are in the proportion of 100-112-113, whereas the index of vegetative growth are 100-111-114. Similar figures for the ratoon trials are: for yield in tons cane per arpent 100-117-129 and for index of vegetative growth 100-119-130.

When these two sets of figures for individual trials are compared, it will be noticed that discrepancies occur in several cases, particularly in the trials with virgin canes. In many cases, however, these discrepancies may be explained. For instance, the cane variety under test, namely M.134/32, has a marked tendency to lodge at a certain stage, and this habit becomes greater the bigger the canes. Canes lying on the ground are more susceptible to damage by rats and consequently the best plots suffer greater loss due to this reason than do the poor ones. If the whole field were lodged to the same extent, then damage due to rats would be more evenly spread over the whole area, and would in aggregate probably not be any more serious than if the canes had not lodged. When the damage is concentrated in certain small areas however, it assumes serious proportions. This type of differential action must therefore be regarded as an accident. Again, canes which have lodged badly are more susceptible to disease, but the incidence of this will remain the same whether the whole field or even portions of it have lodged. This factor must therefore be considered as a normal one affecting the particular variety.

The weights of leaf samples (30 leaves of third rank) from these $3 \times 3 \times 3$ experiments were submitted to statistical analysis by the analysis of Variance, and the error of the trials was much less than the corresponding error calculated from the weights of cane at harvest. Moreover with quantities of fertilizers applied, there is no apparent reason why the single dose should cause a reduction in yield compared with the plots receiving none, nor why the double application should cause a reduction in comparison with the single. Yet it will be found that there are more anomalies of this nature in the indices calculated for the comparative yield of millable cane than in the figures for the index of vegetative growth. In other words the latter figures agree better with the Law of Diminishing Returns. More definite information will be available when the ratoon crops have been harvested during 1947, but for the present it is considered that the "Index of Vegetative Growth" is a reliable method for assessing the effect of fertilizers applied to the different plots in fertilizer trials. This conclusion is supported by some results reported later in this report.

Foliar Diagnosis

The method of taking the sample of leaves in the field has remained the same, namely with virgin canes the sample is taken when the canes are 8-10 months old during the season of maximum growth, whilst for ratoons they are taken from canes 5-7 months old during the same season. The leaves taken are the third from the top, the unrolled leaves counting as number one. The procedure in the laboratory has, however, been radically changed, in that previously the whole leaf sample was cut into small pieces, dried, and a sub-sample was reduced to powder in a mill, whereas now the sub-sample is taken from the lamina of the leaf by means of a leaf punch technique, and the portions cut out by the leaf punch are dried, and subsequently analysed directly without further pre-treatment. In this way, none of the midrib is included in the sample for analysis and the figures for the optimum contents of N, P_2O_5 and K_2O have had to be re-determined.

The series of trials reaped during the year have provided ideal material for this purpose, and during 1947, these same trials will be harvested in ratoons, so that further important data will be available after the next crop. Table (B) shows that the average foliar diagnoses for the selected plots which gave an average yield greater than that of the most heavily fertilized plots (2, 2, 2) is as follows—

N	...	...	2.19% dry Matter
P $\frac{2}{5}$	...	...	0.50 "
K $\frac{2}{0}$	...	...	1.62 "

As these figures were obtained from the best plots in each virgin trial, selected on the basis of vegetative leaf index, they might be considered as being very near to the optimum contents in the dry matter sampled by the leaf punch technique.

The determination of the optimum foliar diagnosis constants was also made by another method. Of the sixteen trials in virgin canes, thirteen, judged by the index of vegetative growth, showed response to nitrogen, six to phosphoric acid and 4 only to potash.

Nitrogen.—From the thirteen trials showing response to N, the figures obtained are shown in Table A₁

TABLE A₁

Results obtained from 13 Virgin Trials showing response to N—

Amount of N. applied per arpent	N% Dry Matter in leaf punch samples	Index of Vegetative Growth.	Comparative Yield of Millable cane	Tons cane per arpent
0 kg.	2.02	100	100	30.3
34 kg.	2.14	112	113	34.3
68 kg.	2.21	118	115	34.9

These figures would seem to indicate that the absolute optimum for nitrogen would be about 2.20 per cent. in the dry matter. The average of the figures for trials showing no response was about 2.25 per cent.

Similar figures were obtained from three ratoon trials all of which showed considerable responses. (Table A₂).

TABLE A₂

Results obtained from 3 Ratoon Trials showing response to N—

Amount of N applied per arpent	N% Dry Matter in leaf punch samples	Index of Vegetative Growth	Comparative Yield of Millable Cane	Tons Cane per arpent
0 kgs. ...	1.51	100	100	26.4
28 kgs. ...	1.77	126	121	32.0
56 kgs. ...	2.00	137	139	36.7

It is obvious from these figures that the application of 56 kgs. of N per arpent has not been sufficient to produce the maximum yield, and consequently the 2 per cent. N in the dry matter is too low, and it may be that the optimum figure for ratoons is about 2.1 per cent.

Phosphate.—Only six out of the sixteen virgin trials showed any response to the application of phosphatic fertilizers, and the average figures for this set is given in table A₃.

TABLE A₃RESULTS OBTAINED FROM 6 VIRGIN TRIALS SHOWING RESPONSE TO P₂O₅

<i>Amount of P₂O₅ applied per arpent</i>	<i>P₂O₅ % Dry Matter in leaf punch samples</i>	<i>Index of Vegetative Growth</i>	<i>Comparative Yield of Millable Cane</i>	<i>Tons Cane per arpent</i>
0 kgs ...	0.45	100	100	33.0
30 kgs ...	0.47	106	102	33.5
60 kgs ...	0.49	109	105	34.6

From these results, it may be taken that the optimum content of P₂O₅ in the cane is about 0.50 per cent. dry matter. In the other 10 trials there was practically no difference between samples taken from the different levels, i.e., 0.50, 0.50 and 0.51.

Potash—Unfortunately only four trials showed a response to applications of potash fertilizers, so that the results are less reliable. The figures for these trials are given in table A₄.

TABLE A₄RESULTS OBTAINED FROM 4 TRIALS SHOWING RESPONSE TO K₂O.

<i>Amount of K₂O applied per arpent</i>	<i>K₂O % Dry Matter in leaf punch samples</i>	<i>Index of Vegetative Growth</i>	<i>Comparative Yield of Millable Cane</i>	<i>Tons Cane per arpent</i>
0 kgs ...	1.06	100	100	23.1
40 kgs ...	1.16	107	104	23.9
80 kgs ...	1.30	110	113	26.0

Increasing the application of potash from 40 to 80 kgs. per arpent has resulted in a considerable increase in the potash content of the leaf and has at the same time increased the Index of Vegetative Growth and the yield of cane per arpent. It would appear therefore that the sugarcane plant, even in the most highly fertilized plots has been unable to absorb sufficient potash for the plant to make maximum growth. In the 12 trials showing no signs of response, the potash content of leaves taken from the three types of plots were all the same, viz : 1.73 per cent. Dry Matter. The optimum K₂O content therefore probably lies between 1.30 and 1.73 per cent. The contents of the leaves from the sixteen selected plots gave an average potash content of 1.62 per cent, and at present the figure adopted is 1.50—1.60 per cent.

This work therefore indicates that the nutrient contents of leaves for optimum growth are, with M. 134/32—

	<i>Leaf Punch Technique</i>	<i>Range</i>	<i>Whole leaf</i>
N ...	2.20% Dry Matter	1.44-2.48	1.45
P ₂ O ₅ ...	0.50 "	0.30-0.70	0.45
K ₂ O ...	1.50-1.60% Dry Matter	0.69-2.28	2.5

The method of sub-sampling the leaf sample has a big effect upon the analytical figures, and in future work only the leaf punch method will be employed. The range of variation for the three elements with the leaf punch technique is large. This is an advantage in diagnosing plant food deficiencies, as the sensitivity of the method is thereby increased.

Foliar Diagnosis with Small Planters' Canes

The Field Assistant in charge of Cultural Operations was at the time of taking leaf samples responsible for carrying out experiments on small planters' lands. He took leaf samples from 23 fields, and at the time of sampling he classified the canes from a visual examination into three groups (a) normal (b) fair and (c) yellow and short. On analysis these groups gave the average results in table IV.

TABLE IV
PLANT NUTRIENT CONTENTS OF LEAVES TAKEN
FROM SMALL PLANTERS' LANDS.

Group	No. of fields	Dry Matter		
		N %	P ₂ O ₅ %	K ₂ O %
(a) Normal	8	1.96	0.42	1.38
(b) Fair	6	1.97	0.40	1.14
(c) Yellow and Short ...	9	1.85	0.40	1.07

Thus the results of foliar diagnostic methods agree with those obtained by visual examination in the field, and it is clear that in the twenty-three fields sampled, all elements were lacking to some degree. Phosphates were lacking to the same degree in all groups. In the case of potash however, there was an increasing deviation from the optimum, the poorer the state of the crop. There was also a considerable drop in the nitrogen content of group (c) compared with groups (a) and (b). It can be confidently stated therefore that small planters' canes are capable of considerable improvement simply by increasing the amounts of fertilizer applied. For the canes to contain normal amounts of N, P₂O₅ and K₂O however, it will be necessary to persevere for several years, as it will be necessary to raise the level of these substances, particularly P₂O₅ and K₂O in the soil at the same time.

Unfortunately the method of foliar diagnosis cannot answer the question, "How much fertilizer is necessary to enable the crop to absorb the optimum quantity of nutrients from the soil." The further the observed values are from the values regarded as the optimum, the higher the application of fertilizer should be. In any case, the application should contain not less than the quantity permanently exported in the crop. If these figures are calculated from those given in Table C then the balance will be on the right side, as canes growing in good conditions will contain higher quantities than those grown in poor conditions.

Permanent Trials at the Central Experiment Station

In trials Bio. 5 and 69 which have been conducted on the same plan for over 10 years, the young ratoon canes in certain plots are showing definite leaf symptoms of a potash deficiency. The potash contents of the leaf samples taken in the optimum growth season in 1946 from the affected plots are around 1 per cent. instead of the optimum of 1.70-1.80 per cent. (Variety M.112/34). The leaves show a spotting and

premature yellowing and drying from the tips and margins, and at one period the young shoots displayed a fan-like formation instead of showing a normal elongation of the spindle. In trial 69, small quantities of potash have been applied annually but in trial Bio. 5 no potash has been given since the start of the experiment, and in addition practically all the green tops together with the cane have been removed annually and consequently there has been considerable depletion of the soil potash during the period that the experiments have been in progress. As a result of these leaf symptoms becoming increasingly evident, the Botanist has started a series of leaf injection experiments, the results of which will be reported later.

In trials Bio. 5 and Bio. 6, there are also leaf symptoms of phosphate deficiency, particularly in the latter, wherein the plots receiving no phosphate are stunted and where the leaves assume a purplish tinge. In trial Bio. 5, the response to phosphate amounted to nearly 7 tons per arpent, and in Bio. 6 increases in the complete fertilizer plots of about 400 per cent. when compared with the no phosphate plots, judged from the weight of the canes at harvest. The amount of P_2O_5 in the dry matter of the leaf punch samples in the two trials is as follows—

	+ P	- P
Bio. 5 :	0.50 % Dry Matter	0.39 % Dry Matter
Bio. 6 :	0.52 % Dry Matter	0.30 % Dry Matter

Composition of the Whole Plant

Advantage was taken of the material available in the sixteen trials with virgin canes to determine the amount of nitrogen, phosphoric acid and potash contained in the different aerial portions of the plant, which is composed of three parts: millable cane, the whole green top and the dry leaves or trash. These portions were taken from those plots wherein it was considered that there was neither excess nor lack of any of these elements. A small area in each selected plot was cut, and the millable canes and whole green top were weighed separately. The weight of trash associated with these portions was estimated by weighing a certain number of dry leaves, counting the number of nodes, and then calculating the total weight of dry leaves. The ratio between millable cane, whole green top and trash was calculated, so that when the whole plot was harvested, the weights of green top and trash could be calculated. Samples of each portion were taken from each of the selected plots, prepared for analysis, bulked and analysed.

That the method of selecting plots for sampling was efficient is shown by the fact that the yield of the 0 : 0 : 0 plots was 29.5 tons per arpent, of the 2 : 2 : 2 plots 33.7 tons per arpent and of the selected plots 35.7 tons per arpent. The average figures for the levels of fertilizers in the 16 selected plots were :

N	...	44	kilos	per	arpent
P_2O_5	...	18	"	"	"
K_2O	...	21	"	"	"

The yields per arpent of the different portions of the cane plant together with the analytical data are given in Table B.

TABLE B

Analysis of Entire Aerial Portion of Cane Plant grown under good conditions—16 Estates—M.134/32/—15 months old.

AVERAGE COMPOSITION										
Fresh Matter Tons per Arpent	H ₂ O % Fresh Matter	Dry Matter		Distribu- tion of Dry Matter %	% Dry Matter			Kilos per Arpent		
		Tons per Arpent			N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Millable Canes ...	35.68	74.1	9.25	60.2	0.23	0.12	0.80	21.3	11.1	74.0
Whole Green Top	10.64	76.2	2.53	16.5	0.88	0.34	2.27	22.3	8.6	57.4
Trash ...	4.66	23.2	3.58	23.3	0.40	0.13	0.90	14.3	4.7	32.2
TOTAL	50.98	69.9	15.36	100.0	0.38	0.16	1.07	57.9	24.4	163.6

From these figures it is evident that a considerable amount of plant nutrients is annually withdrawn from the soil by a well-grown crop of sugarcane, somewhat less than one half being contained in the millable cane, and the remainder in the green tops and trash. Needless to state, the millable canes are annually exported from the field, and in addition considerable quantities of green tops and trash are also exported for the purpose of feeding to animals and for use as litter respectively. A large proportion of green tops and litter is probably taken out of the small planter's fields, and after being converted into pen manure by means of the draught bullock or dairy cow is sold, thus resulting in a permanent loss of plant nutrients from his soil. These figures show the need for efficient restitution as a prime necessity to avoid lowering the level of soil fertility. Any impoverishment of the soil may have a serious effect upon the economy of the Colony. If the plant nutrients removed from the soil in the crop exported from the fields are not replaced in the factory residues or pen manure prepared from this crop, then increased quantities of fertilizers will be required.

An interesting comparison can be drawn between results obtained by analysis of canes, green tops and trash taken from 72 fields of M.134/32 in 1944 with the results obtained from analysis of samples from the sixteen virgin trials harvested in 1946. In this case the results are presented in terms of kilos of nutrient associated with one ton of millable cane.

TABLE C

Kilos of Plant Nutrients associated with one ton of millable cane grown in good conditions—

1944						1946					
72 Fields of Ratoons- 12 months old						16 Fields M. 134/32- Virgins 15 months old					
		N	P ₂ O ₅	K ₂ O				N	P ₂ O ₅	K ₂ O	
Millable Cane ...	...	0.57	0.48	2.10		0.60	0.31	2.08			
Whole Green Top ...	...	0.65	0.28	1.80		0.63	0.24	1.61			
Trash ...	...	0.39	0.16	0.82		0.40	0.13	0.90			
Total ...	...	1.61	0.92	4.72		1.63	0.68	4.59			

Note : Variation for average.

This table serves to show the similarity between ratoon canes 12 months old and virgin canes 15 months old ; the quantities removed by the different fractions being practically the same. These figures may be considered as a very reliable basis on which to calculate how much N, P_2O_5 and K_2O has been removed from any well-cultivated field in the exported material. Thus with a crop of 30 tons of cane per arpent, if only the cane is removed, then the loss of Nitrogen is 18 kilos, of P_2O_5 12 kilos and of K_2O about 62 kilos, but if cane, green tops and trash are removed the quantities become 49 kilos, 24 kilos and 138 kilos.

In the case of P_2O_5 and K_2O , most of these removed in the cane appear in the molasses, scums and ashes produced in the factory, so that the return of these residues eliminates any large depletion of the soil stocks of these nutrients. In the case of nitrogen, however, these residues only contain relatively small amounts, a large loss of nitrogen occurring in the burning of the bagasse in the furnaces. In any case, any nitrogen returned is in the organic form, and therefore probably not very quickly available for plant growth. To produce one ton of cane, it is seen that approximately 1.6 kilos of nitrogen is required for the aerial portion of the cane. Of this, part is supplied by the nitrogen reserves in the soil, and part by nitrogen applied as fertilizers. An application of 1 kilo of nitrogen per one ton of cane expected is, on the average, a useful guide to the quantity of nitrogenous fertilizer to be given.

Composition of Molasses

During the war, a large proportion of the molasses produced had, of necessity, to be diverted from the fields to the distilleries, in order to produce power alcohol for use in internal combustion engines. At the same time, imports of potash fertilizers were reduced to a minimum.

During the crop season of 1946, representative samples of molasses were collected from 21 mills throughout the Colony during the month of September, i.e., the middle month of the crushing season. These 21 samples were analysed and the following figures were obtained :

	N	P_2O_5	K_2O
Minimum ...	0.32%	0.12%	3.36%
Maximum ...	0.76%	0.35%	7.60%
Average ...	0.52%	0.25%	5.14%

These figures show that the amounts of nitrogen and phosphoric acid in molasses are not very important, but that the potash content is high. On an average, 100 tons of cane give about 3 tons of molasses containing about 154 kilos of K_2O . In other words each ton of cane exported from the field carries with it 1.54 kilos of K_2O which is recovered in the molasses. Table C above shows that the total quantity of potash removed in one ton of millable cane is about 2.10 kilos, so that approximately 75 per cent. is recovered in the molasses. Thus by returning to the soil all the molasses manufactured from the canes derived from the soil, a large proportion of the potash is returned, thus reducing the amount of potash fertilizer required to maintain the soil in

its former condition. If a field has produced 30 tons of cane, one ton of molasses containing 51 kilos K_2O will be manufactured. This amount of potash is contained in about 100 kilos of muriate of potash or 125 kilos of Indian nitrate of potash.

Demonstration Plots on Small Planters' Lands

Provision has been made in the Development and Welfare Estimates for 1946-47 for the appointment of one Senior Field Demonstrator and six Field Demonstrators, the object of these to be the improvement of field methods used in the cultivation of sugarcane by small planters. Applications for three posts of Field Demonstrators were invited during the month of December, but no appointments had been made by the end of the year.

In spite of this, however, nine demonstration plots have been started, only two being harvested during the course of the year. The two trials harvested contained four series of plots viz: N, NP, NK, and NPK, each replicated four times in a 4×4 Latin Square layout. In the one conducted for the Camp de Masque Co-operative Credit Society, the phosphatic guano was not applied at plantation, but later, and there was no response to phosphate, and a small response of 2.2 tons cane per arpent to potash. In the other conducted on a land belonging to the Nouvelle Société de Mont Ida the phosphatic guano was applied at plantation and there was a response of 3.2 tons of cane per arpent to this fertilizer and of 2.0 tons to potash fertilizers. The NPK plots yielded 22.3 tons of cane per arpent against 17.2 tons for the nitrogen only plots, the trial having been harvested at the age of 14 months.

The layout in the remainder of the plots is different from the two described above, the planters' usual method of applying fertilizers being compared to that suggested by the Sugarcane Research Station for the particular locality. In addition four or five of the newer varieties of cane are tested and are compared to the variety normally cultivated by the planters. They are regarded not so much as trials capable of statistical analysis, but rather as demonstration plots, the results of which can be seen by the planters themselves at harvest time. This is the method which was employed with so much success at Lallmatie etc., during the Uba Replacement Scheme. By extending this service, it is hoped to raise the level of cultivation amongst small planters throughout the Colony; this should result in a not inconsiderable increase in the total crop.

N. CRAIG.
Senior Chemist.

PART III—RESEARCH BOTANY

General.—The Botanist returned from European leave on 4th May, 1946, and on that date resumed work in the Sugarcane Research Station after an absence, on war-time duties, of $4\frac{1}{2}$ years. The long range field experiments on various cultural operations organized by the Botanical Division had to be abandoned during the war years owing to the secondment of the Botanist to war-time duties and the promotion of the Scientific Assistant to the post of Agronomist.

Previous to his promotion the Scientific Assistant had commenced a survey of the weed situation in the island and a certain amount of exploratory work on the weed problem was carried out by Mr. Feillafé on his appointment as Acting Scientific Assistant, both under the supervision of the Senior Chemist.

In view of the paramount importance of the problem of weed control at the present time the Botanical Division has been engaged in active research work on this subject during the year.

Weed Control Investigations.—As has been mentioned in previous reports the weed problem became acute as a result of the placing of 27.5 per cent. of sugarcane plantations under food crops and the shortage of labour during the war years. Certain noxious weeds which had already commenced to encroach on cultivated land many years before the war spread at an alarming rate and large areas became highly infested.

A good picture of the weed situation resulted from the detailed survey of the districts of Black River, Plaines Wilhems and Flacq made by Mr. d'Emmerez. In this survey detailed data were obtained on the incidence and ecology of the more serious weeds in these districts, at various times during the year.

In order to complete the data for the whole island a questionnaire was sent out to the managers of all estates in areas which had not been previously surveyed in detail and a fairly comprehensive picture of the weed problem in the island as a whole is now available. The island distribution of the more important noxious weeds is shown in Figure I.

Work on the classification and identification of weeds, the study of their growth habits and field behaviour and their methods of propagation and dispersal have been continued as time permitted but attention has been given chiefly to methods of control.

In Mauritius weeds have been classified by the planters into "bad," "moderate bad," and "relatively harmless" weeds according to the difficulty or ease with which they can be eradicated by cultural methods and the extent of damage to the cane crop caused by the particular weed. While this classification may not be consistently adhered to in various parts of the island, it forms a useful guide.

In general, it transpires that those weeds which are classed as "bad" are characterized by having efficient methods of vegetative propagation, are deep-rooted, are of very active growth or exercise a noticeably harmful effect on the growth of the cane.

The number of weeds which are universally reported as bad are not very numerous as regards species. They are listed below—

- **Cordia Macrostachya* (Herbe Condé)—Boraginaceæ.
- **Cynodon dactylon* (Chiendent)—Gramineæ.
- **Phalaris arundinacea* (Herbe Mackaye or Herbe Feu)—Gramineæ
- **Echinocloa colona* (Herbe Sifflette)—Gramineæ.
- **Mikania scandens* (Liane Margoze, Liane Pauline or Liane Raisin)—Compositæ.
- **Hydrocotyle bonariensis* (Herbe Oreille, Herbe Bol or Tam-Tam)—Umbelliferæ.
- Ipomea cairica* (Liane Lastique)—Convolvulaceæ.
- Striga hirsuta* (Herbe Feu, Herbe feu a fleurs rouges)—Schrophulariaceæ.
- Asystasia gangetica* Herbe pistache or Herbe piment)—Acanthaceæ.
- Alocasia macrorrhiza* (Songe blanc or Songe sauvage)—Aroideæ.
- Plantago lanceolata* (Plantain or Herbe Caroline)—Plantaginaceæ.
- **Artemesia vulgaris* (Herbe or Brede Chinois)—Compositæ.
- Panicum maximum* (Herbe Fataque)—Gramineæ
- Wikstræmia viridifolia* (Herbe Tourterelle)—Thymelaceæ.
- Ipomea coccinea* (Liane patate)—Convolvulaceæ.
- Digitaria* spp. (*D. timorensis*, *D. adscendens* and *D. horizontalis*—collectively known as Meinki or Menki)—Gramineæ.
- Ischæmum aristatum* (Herbe d'Argent)—Gramineæ.
- **Pæderia fætida* (Liane lingue)—Rubiaceæ.
- **Ambrosia artemisiifolia* (Herbe Solferino)—Compositæ.
- Setaria barbata* (Herbe Bambou)—Gramineæ.
- **Cyperus rotundus* (Herbe a Oignon)—Cyperaceæ.

Of these weeds, those marked with an asterisk are particularly troublesome and their eradication would mean a tremendous saving in the weed-cleaning bill as well as greatly increasing the value of land in the Colony as a whole.

Cordia macrostachya, *Cynodon dactylon* and *Pæderia fætida* are troublesome in practically all parts of the island while the remainder are a menace in certain climatic zones where they find the ecological conditions suitable for their more or less unrestricted development.

In addition to the above list of "bad" weeds there is a longer list of moderately bad weeds some of which, however, may be considered as bad in certain restricted localities. These are as follows:—

- Commelyna benghalensis* (Herbe Cochon)—Commelynaceæ.
- Commelyna communis* (Herbe Cochon, petite espèce)—Commelynaceæ.
- **Bignonia Unguis cati* (Liane patate or Patte de Poule piquant)—Bignoniaceæ.

- **Paspalum vaginatum* (Herbe Lamare)—Gramineæ.
- Panicum umbellatum* (Gazon Chinois)—Gramineæ.
- Colocasia antiquorum* (Songe Noir)—Aroideæ.
- Cassytha filiformis* (Liane sans fin)—Lauraceæ.
- Cuscuta reflexa* (Cuscute)—Convolvulaceæ.
- Litsea glutinosa* (Bois d'Oiseaux)—Lauraceæ.
- Acacia concinna* (Chikakai, Sappan)—Leguminosæ.
- **Lantana camara* (Vieille fille)—Verbenaceæ.
- **Mimos pudica* (Sensitive)—Leguminosæ.
- Tylophora lœvigata* (Ipecca sauvage)—Asclepiadaceæ.
- Schinus terebenthifolius* (Poivre sauvage)—Anacardiaceæ.
- **Tridax procumbens* (Herbe Caille)—Compositæ.
- **Argemone mexicana* (Chardon, Chardon du pays)—Papaveraceæ.
- Heteropogon contortus* (Herbe Polisson)—Gramineæ.
- Rubus rosæfolia* (Petite framboise)—Rosaceæ.
- Rubus roridus* (Framboise marronne)—Rosaceæ.
- **Bidens pilosa* (Ville Bague)—Compositæ.
- **Siegesbeckia orientalis* (Herbe Flacq)—Compositæ.
- **Acalypha indica* (Herbe Chatte)—Euphorbiaceæ.
- **Ageratum conyzoides* (Herbe Bouc)—Compositæ.
- **Sida acuta* (Herbe panier)—Malvaceæ.
- **Parthenium hysterophorus* (Herbe Blanche)—Compositæ.
- Elephantopus scaber* (Herbe Moka)—Compositæ.
- **Euphorbia hirta* (Jean Robert)—Euphorbiaceæ.
- **Sonchus oleraceus* (Lastron or Sow thistle)—Compositæ.
- **Lactuca indica* (Lastron, Laitron)—Compositæ.
- **Sonchus asper* (Lastron piquant)—Compositæ.
- Oxalis corniculata* (Oseille filante)—Oxalidaceæ.
- **Oxalis corymbosa* (Oseille, trefle)—Oxalidaceæ.
- **Alternanthera sessilis* (Brede Emballage, Serenti)—Amaranthaceæ.
- Verbena officinalis* (Verveine)—Verbenaceæ.
- Oenothera rosea* (vernacular name not known)—Onagraceæ.
- Cassia occidentalis* (Casse puante)—Leguminosæ.
- **Stachytarpheta indica* (Queue de rat)—Verbenaceæ.
- Solanum indicum* (Endive sauvage)—Solanaceæ.
- Cenchrus echinatus* (Herbe Cateaux)—Gramineæ.
- **Cardiospermum helicacabum* (Liane poc-poc, Bonnet de Prêtre)—Sapindaceæ.
- Phyllanthus urinarea* (Kirganelli)—Euphorbiaceæ.
- Jussiaea suffruticosa* (Gandia marron, Herbe Josephine, Herbe La Mère)—Onagraceæ.

- Rottbællia exaltata*—Gramineæ.
- Solanum auriculatum* (Tabac marron)—Solanaceæ.
- **Acanthospermum hispidum* (Tricorne)—Compositæ.
- Solanum nigrum* (Brede Martin)—Solanaceæ.
- **Apium leptophyllum* (Anis Sauvage)—Umbelliferæ.
- **Euphorbia peplus* (Herbe Lait)—Euphorbiaceæ.
- Crotolaria fulva* (Cascavelle jaune)—Leguminoosæ.
- Lobelia cliffortiana* (Brede Mamzelle)—Lobeliaceæ.
- Torilis nodosa* (Carotte sauvage)—Umbelliferæ.
- Daucus carota* (Carotte sauvage, Carotte-fleur)—Umbelliferæ.
- Medicago denticulata* (Luzerne sauvage)—Leguminoosæ.
- Melilotus alba* (Melilot blanc)—Leguminoosæ.
- Melilotus indica* (Melilot jaune)—Leguminoosæ.
- Anagallis arvensis* (Mouron)—Primulaceæ.
- Senebiera didyma*—Cruciferæ.
- Vicia sativa*—(Lentille sauvage)—Leguminoosæ.
- Chenopodium ambrosoides* (Botrice)—Chenopodiaceæ.
- Euphorbia thymifolia* (Petite Rougette)—Euphorbiaceæ.
- Cynoglossum rochellia*—Boraginaceæ.
- **Hydrocotyle asiatica* (Herbe Boileau)—Umbelliferæ.
- **Passiflora suberosa* (Liane poc poc)—Passifloraceæ.
- Passiflora fatida* (Grenadine sauvage)—Passifloraceæ.
- Isotoma longiflora* (Poison dos cavalcados)—Lobeliaceæ.
- Amaranthus caudatus* (Brède malabar)—Amaranthaceæ.
- **Convolvulus sp.* (Liseron)—Convolvulaceæ.
- **Pennisetum clandestinum* (Joba, or Zoba, Herbe Anguille, Kikuyu)—Gramineæ.
- **Kyllingia polyphylla* (Herbe Madras, or Mota)—Cyperaceæ.
- Cyperus distans*—Cyperaceæ.
- Pycnus odoratus*—Cyperaceæ.
- Thunbergia fragrans* (Liane blanc)—Acanthaceæ.
- Portulaca oleracea* (Pourpier)—Portulacaceæ.
- Emex spinosus*—Polygonaceæ.
- Borreria ocymoides*—Rubiaceæ.
- **Conyza lineariloba* (Herbe Gandia)—Compositæ.
- Blumea lacera*—Compositæ.
- Eleusine indica* (Chiendent patte de poule)—Gramineæ.
- Eragrostis cilianensis* (Stink grass)—Gramineæ.
- Chloris pycnathrix* (Chloris)—Gramineæ.
- **Setaria pallide fusca* (Millet sauvage, Herbe Millet)—Gramineæ.
- Stenotaphrum dimidiatum* (Herbe Bourrique)—Gramineæ.
- Verbena bonariensis* (Verveine sauvage)—Verbenaceæ.
- Sisyrinchium chilense*—Iridaceæ.
- Milla borbonica* (Ail sauvage)—Liliaceæ.

Distribution of certain noxious weeds in mauritius



Fig. 1.

The above list, while only representing a small proportion of the weed species which occur in cane fields include most of those weeds which by virtue of their numbers, persistence and rate of growth have a considerable nuisance value and on the eradication of which considerable sums are expended.

The results of experiments performed on possible methods of eradicating these weeds are briefly presented here.

It will be noted that an appreciable number of the "bad" as well as "moderately bad" weeds are members of the grass (Gramineæ) and Sedge (Cyperaceæ) families. The Gramineæ in particular are hardly affected at all by the new hormone type weed killers, any slight effect produced on the growth of these grasses is of no significance in the control of these weeds under field conditions. Most of the Cyperaceæ occurring in Mauritius are also highly resistant to the hormone weed killers. Grasses and Sedges are also very resistant to the D.N.O.C. series of compounds and to Copper Chloride. They are generally susceptible to high dosages of Sodium Chlorate and this substance has been the only reasonably effective chemical which has been available for experimentation. Orders were placed several months ago for supplies of Ammonium Sulphamate and for Sodium Pentachlorophenate which was found in Hawaii greatly to activate the weed killing properties of Sodium Chlorate. These substances have not yet arrived in the Colony and therefore only some exploratory work against the grasses and sedges have been commenced.

Gramineæ

Cynodon dactylon (Chiendent).—This weed would probably be unanimously classified as the worst weed of cane fields in Mauritius. It is highly resistant to M.C.P.A* and D.C.P.A† weed killers. Applications of up to 1.5 per cent of these substances merely resulted in slight browning of the older leaves. Applications of D.N.O.C. weed killers at rates up to 4 per cent. caused some scorching of the leaves but recovery is very rapid. The best results were obtained with Sodium Chlorate. In the cold wet uplands where the rhizomes only penetrate to 8–10 inches complete control was obtained by one spraying with 10 per cent. Sodium Chlorate. Under less favourable conditions it was found that one spraying was not sufficient but if the spraying of the aerial portions was followed by a ploughing operation in which the soil is turned over and the exposed rhizomes given a second spraying with 10 per cent. Sodium Chlorate, very good control was obtained.

Under dry conditions, however, where rhizomes penetrate to 4 feet or more—even three sprayings with 15 per cent. Sodium Chlorate did not give complete control.

As the cost of Sodium Chlorate is high at present (approximately Rs. 900 per ton) and, in addition, supplies are not available, it was decided to postpone further work on this weed pending arrival of the Sodium Pentachlorophenate activator, Ammonium Sulphamate and other

(*)—Sold locally as Methoxone or Agroxone

(†)... ,, ,, Weedone, 2-4 D, etc.

substances of value against grass weeds. The cost of Ammonium Sulphamate is also high and even assuming that it will give successful control—it is unlikely to be employed on a large scale at present for this reason.

Phalaris arundinacea (Mackaye).—This is a grass weed of the wet districts. Like Chiendent it has a particularly depressing effect on cane growth and several acres of cane land has been abandoned because of infestation by this weed. Though considerably more susceptible to the M.C.P.A. and D.C.P.A. weed killers than Chiendent there appears to be no hope of controlling it with these substances. The rhizomes are not affected by treatment with the D.N.O.C. compounds nor by Copper Chloride. It is more susceptible than Chiendent to Sodium Chlorate. One application of 10 per cent. Sodium Chlorate at 100–150 gallons per acre has repeatedly given a good control—well over 80 per cent. of rhizomes being killed. There is little doubt that this weed can be completely eradicated with Sodium Chlorate providing that planters are prepared to destroy the weed when the field is in fallow as the dosages of chlorate required may do considerable damage to growing canes. The indications from the experiments carried out at present are that complete control may necessitate two or possibly three sprayings with 10 per cent. Sodium Chlorate. The cost of this material at current prices would be Rs. 72–100 per acre. There is no other method of controlling the weed which is as cheap; removal of the rhizomes by hand labour would cost well over Rs. 600 per acre even assuming that labour was available. It is possible that further experiments with the addition of activators may reduce the dosage of Sodium Chlorate required. It has been found that when Sodium Chlorate is sprayed on the foliage at approximately 100 gallons per acre there is very little penetration of the chlorate into the soil and, therefore, very little residual toxic effects. The chlorate which penetrates the the plant tissues is fairly rapidly reduced to chloride. Certain annual weeds which grew in the chlorate plots three weeks to one month after the application of the treatments showed no signs of chlorate toxicity. Even a cane crop showing two to three feet of cane at the base was practically unaffected by the chlorate spray but young cane and young tillers of older cane may suffer more or less severe damage.

Echinochloa colona (Herbe Sifflette).—This grass is considerably more resistant to Sodium Chlorate than Chiendent and Mackaye. Nevertheless the aerial portions can be completely destroyed by spraying with 10 per cent. chlorate and two or three applications give a good degree of control although the weed is not eradicated. The tough rhizomes of this species may penetrate to 4 feet or more. None of the other weed-killers available were of any value against this weed.

Panicum Maximum (Herbe Fataque).—Only one experiment has been carried out on this weed. In this instance the grass was killed outright by one spraying with 10 per cent. Sodium Chlorate.

Ischæmum aristatum (Herbe d'Argent).—In freshly invaded areas this grass can be killed with Sodium Chlorate spraying with 10 per cent., concentration. Where it has been securely established for some time much higher dosages of chlorate are necessary.

Setaria barbata (Herbe Bambou).—In a few experiments has been killed completely by spraying with Sodium Chlorate of 10–15 per cent., concentration. More work is required to determine the most economical dosages to use against the weed under different ecological conditions.

Digitaria spp. (Meinki).—This class of grass weed is fairly easily destroyed by Sodium Chlorate—one application of 10 per cent., chlorate being generally sufficient to obtain complete eradication.

Summary of results with Gramineaceous weeds.—The only active substance which has been available for testing against the grasses is Sodium Chlorate. This gives full control of those annual grasses which have no rhizomes and of those perennials which have superficial rhizomes. For perennials with deeply penetrating rhizomes the quantity of chlorate necessary is uneconomic.

In America the use of oils of high aromatic and olefine content for the selective killing of grasses is being increasingly practised.

A few experiments with Diesel oil against Chiendent were carried out but although the aerial portions were effectively scorched the rhizomes were undamaged at the dosage used (60–100 gallons per acre). Further experiments will be carried out with toxic oils when these become available.

An efficient and economic method of controlling rhizomatous Gramineaceous weeds is the most urgent requirement in the weed control programme.

Cyperaceæ

Cyperus rotundus (Herbe à Oignon, Nut Grass).—This is undoubtedly the worst weed of this family in Mauritius. It is a particularly bad pest in the dry and intermediate rainfall districts particularly on irrigated lands in these regions. It has been claimed from St. Lucia and from Louisiana that this weed was completely controlled by D.C.P.A. at the relatively low dosages of 0·1–0·2 per cent.

Previous experiments carried out here had shown that the weed could not be effectively controlled with Sodium Chlorate.

Experiments were carried out during the current year at Pamplémousses Experiment Station using liquid M.C.P.A. at 0·05 per cent., 0·1 per cent., 0·15 per cent., and 0·20 per cent., and solid M.C.P.A. at 50, 100 and 150 kilos per acre.

The M.C.P.A. resulted in yellowing and final death of the aerial shoots—the percentage of total shoots affected increasing with increasing dosage to 90–100 per cent. with 0·20 per cent. liquid M.C.P.A. or 150 kilos solid M.C.P.A. It was noted that the bulb immediately at the base of the shoot was killed and frequently the first true tubercle below this but the effect did not progress further than the first true tubercle. In the affected tubercle the endodermis first became discoloured and the organ finally rotted. Following fairly heavy rain there was a remarkable

emergence of new shoots from unaffected tubercles. The plots were, therefore, given a second application at the same rate as the first application. The effect of the second application, possibly owing to frequent showers, was not as marked as the first application but a considerable number of aerial shoots were killed. New shoots were emerging so rapidly that within a month of the second application the growth of the weeds was as vigorous as it was before any treatments were applied.

A second experiment in which plots were sprayed with 0·3 per cent. and 0·5 per cent. M.C.P.A. at Ebène S.E. gave similar results—the aerial shoots were killed completely within a month of the application but new shoots were emerging before the full effects of the treatment on the existing shoots were complete.

In a larger field experiment at Ebène (Highlands S.E.) plots were treated with D.C.P.A. in the acid form, a proprietary product—Phenoxyl of which the active principle was M.C.P.A., a proprietary D.C.P.A. American product called "Weedone" and the I.C.I. product methoxone (M.C.P.A.) all at concentrations of 0·1 per cent., 0·2 per cent., and 0·3 per cent. applied once only at 100 gallons per acre and applied twice with the exception of "Weedone" of which there was only sufficient available to treat one plot with 0·2 per cent. The results obtained showed a remarkable difference in activity between the various hormone preparations. The pure D.C.P.A. was the least effective and the Weedone (also a D.C.P.A. product) the most effective. There was, however, little difference between M.C.P.A. (Methoxone) and "Weedone."

In all cases, even after two applications of 0·3 per cent. there was a vigorous regrowth of the weed after an initial killing of the existing aerial shoots. Examination showed that only the first tuber at the base of the aerial shoot was killed—the rhizomes and the large number of further tubers attached to each plant being unaffected. Observations are now being made following treatment of the weed with 0·75 per cent. M.C.P.A.

There is little doubt that repeated applications would probably eventually kill this weed since the shoot produced by each tuber could be killed before it had time to produce new tubers. It is not believed that this would be found economic. Two applications of 0·3 per cent. at current prices cost Rs. 90 per acre for the cheapest product available. Further experiments with M.C.P.A. and D.C.P.A. products are envisaged as soon as supplies become available in order to determine the most effective preparation. If it should prove uneconomical to spray the whole surface area it might still be found profitable to spray the furrow or holes in which the young cane plants are growing, until such time as their growth suppresses the weed. By confining the spraying to the immediate vicinity of the cane stool the same volume of liquid could be used to spray three to four times the area. There were indications that the solid forms of these substances may be more effective than the liquid for this particular weed,

Kyllingia polyphylla (Herbe Madras, Mota)—This Cyperaceous weed generally replaces *Cyperus rotundus* in the cold wet uplands. It is considerably larger than *Cyperus rotundus*. It has proved extremely resistant to M.C.P.A. and D.C.P.A. being relatively unaffected—except for a yellowing of the older leaves, by concentrations up to 1·5 per cent. (15 lbs per acre of M.C.P.A. and D.C.P.A.). It is also resistant to 10 per cent. Sodium Chlorate—the leaves only being killed.

Further experiments with this weed will be carried out in due course : at present there is no successful chemical control method available.

Cyperus distans and *Pycnus odoratus*.—These two species have occurred as associates of other weed communities and the information available was obtained incidentally in experiments to control other weeds. *Cyperus distans* proved resistant to all the D.N.O.C. compounds including the activated products "Denoc" and "Denocate." There was considerable yellowing of the leaves but the plants were not killed by 0·1 and 0·2 per cent. M.C.P.A.

Pycnus odoratus on the other hand was completely killed by one application of 0·2 per cent. M.C.P.A.

Summary of results with the Cyperaceous weeds.—The effects of M.C.P.A. and D.C.P.A. on the two worst Cyperaceous weeds—*Cyperus rotundus* and *Kyllingia polyphylla* have proved disappointing in view of the success claimed in the control of the former in the West Indies and the United States. Further work will be carried out when supplies of these substances become available, but the results obtained to date indicate that the concentrations and/or number of applications required may be uneconomic.

Umbelliferae

Hydrocotyle bonariensis (Herbe Bol, Herbe Oreille, Tam-Tam). This plant is a very serious weed in the wet and medium rainfall districts, covering the ground in a luxuriant vegetation in which few other weeds manage to become established.

Samples taken from areas of one square metre in the infested parts of the island gave a mean of 13 tons leaves and 22 tons rhizomes—a total of 35 tons of fresh material per arpent (1·04 acres). This was equivalent to 3·7 tons of dry matter per arpent.

Nitrogen content per cent. of the dry matter was in the range of 2·12–3·32 for leaves and 1·12–1·80 for rhizomes; corresponding ranges for K_2O were 3·58–4·80 for leaves; 2·30–3·30 for rhizomes and for P_2O_5 0·91–1·22 for leaves and 0·84–0·89 for rhizomes. It was calculated that this weed contained per arpent 85, 100 and 37 kilos of N, K_2O and P_2O_5 respectively, in these highly infested regions.

Experiments carried out prior to the arrival of hormone type weed killers showed that all the D.N.O.C. compounds, Copper Chloride and Sodium Chlorate merely resulted in a scorching of the leaves and within a week or ten days there was an abundant growth of new leaves.

The plant proved, however, to be remarkably susceptible to M.C.P.A. and D.C.P.A. Even one spraying with 0.05 per cent. completely killed the aerial parts and new leaves emerging subsequently also became affected by the active substances. In the experimental work carried out on this weed it was found that two sprayings with 0.15 per cent. or one spraying with 0.3–0.5 per cent. M.C.P.A. completely killed the weed—even the rhizomes became discoloured and rotted. Out of a large number of rhizomes removed from the fields in these experiments and planted in boxes under observation at Reduit—only one leaf was formed and this after about two months. It was found that this leaf emerged from a small swelling on a rhizome which had not been killed completely.

Demonstration plots for the control of this weed in which areas up to $\frac{1}{2}$ arpent were sprayed were laid out. A single spraying with a concentration of 0.25 per cent. gave 80–95 per cent. control of the weed.

As the temperature increased with the approaching hot season the rate of kill of the rhizomes of the weed became successively poorer. The percentage of the rhizomes killed by spraying with 0.3–0.5 per cent. decreased from 100 per cent. in July–August to 20–30 per cent. in December. This result is in apparent contradiction to frequently made statements in the literature that these substances are more effective the higher the temperature. The explanation of this apparent contradiction appears to be as follows. The direct effect of the application as indicated by the reaction of the leaves does increase with increasing temperature—the leaves taking 10 days to completely yellow and shrivel in the cool months of July–August as compared to 4–5 days in December. New leaves that come up following the death of the existing leaves themselves became affected—turning yellow and dying in 3–4 days in the cooler months. This sequence of leaf formation with resulting death continued for 5–6 weeks in the winter months and it took 2 months for the rhizomes to die and rot. In the hot summer months new leaves which emerged following the death of the existing leaves were not affected by the hormone—which appeared to exert little or no residual effect. Re-establishment following the initial spraying was also much faster under the conditions of high temperature and humidity obtaining in the summer months. Thus a complete kill of the weed in one application could not be obtained in the summer months even when concentrations of 0.75–1.0 per cent. were used. There is little doubt that M.C.P.A. and D.C.P.A. are quickly decomposed in the soil in the hot season in Mauritius. For this reason almost equally good results were obtained in the hot season with 0.15–0.20 per cent. as with 0.75–1.0 per cent.

It is, therefore, recommended that during the hot season these substances should only be used in low concentrations of approximately 0.1 per cent. to suppress the growth of the weed and that all attempts to eradicate the weed completely should be postponed until the months of June–August, when concentrations of 0.3–0.5 per cent. may be expected to exert full or at least eminently satisfactory control.*

* Later work has shown that even in the hot season the weed can be eradicated by three applications of 0.1 per cent. or by 3–4 applications of 0.05 per cent.

Hydrocotyle asiatica (Boileau).—This plant while being a bad weed of lawns in the cooler uplands appears to be a serious cane field weed only in the Savanne district. In preliminary experiments in lawns it was completely killed by one application of 0·2 per cent. M.C.P.A. In larger scale trials in cane fields there was a certain amount of re-growth after one spraying of 0·2 per cent. or one application of 300 kilos per arpent of the solid M.C.P.A. (in 1 per cent. dilution as agroxone). It thus appears that frequently two applications may be necessary for effective control of the weed.

Hydrocotyle sibthorpioides.—This is mainly a lawn weed and seldom occurs to any appreciable extent in cane fields. It is killed completely by 0·2 per cent. M.C.P.A.

Apium leptophyllum (Anis Sauvage).—An annual weed which assumes local importance in cane fields particularly in the warmer districts. Providing it is treated before the stem becomes hard and woody it can be killed completely by 0·15–0·20 per cent. M.C.P.A. or D.C.P.A. or by any of the D.N.O.C. weed killers.

Torilis nodosa and *Daucus carota* (Carotte Sauvage).—Both these weeds are readily killed by 0·2 per cent. M.C.P.A. and by D.N.O.C. weed killers if the latter are applied before the base of the stem becomes hard and woody.

Summary of results with Umbelliferous Weeds.—The fact that complete control of all the noxious umbelliferous weeds of which the most important by far is Herbe Bol (*Hydrocotyle bonariensis*) was obtained in the cool season using 0·3–0·5 per cent. M.C.P.A. or D.C.P.A. and that even in the hot season control of the weed can be obtained with repeated applications of 0·1 per cent. M.C.P.A. or D.C.P.A. suggests that Herbe Bol may eventually be eradicated from cane fields in Mauritius by the use of these substances. Further experimentation is required to determine the optimum conditions for complete eradication and the most economical use of the hormone preparations. Nevertheless it is believed that in a few years several thousand acres heavily infested with this weed may be rendered free of the weed with resulting decrease in costs of cane cultivation and probable increases in the yield of cane.

Compositæ

This family is well-represented in the cane fields of Mauritius, contributing three of the "bad" weeds and several of the moderately bad and relatively harmless weed flora.

Ambrosia artemisiifolia (Herbe Solferino).—This weed finds the most suitable environment for unrestricted growth in the rocky soils of the dry and intermediate rainfall districts but is at present, with the exception of small centres of infection, confined to the districts of Black River and Plaines Wilhems. Planters of this region whose properties are heavily infested regard it as being particularly serious as its effect on cane growth is very noticeable.

The whole series of weed killers available has been tested against this weed. The D.N.O.C. compounds including their activated form and Copper Chloride resulted in complete scorching of the aerial parts when used at high concentration (4 per cent in the case of D.N.O.C. compounds and 8 per cent., in the case of Copper Chloride) but had no effect on the rhizomes. Very good results were obtained, however, with M.C.P.A., D.C.P.A. and Sodium Chlorate.

Applications of M.C.P.A. in both solid and liquid forms showed an increase in the percentage of plants (including rhizomes) killed with increasing concentration of the active substance. Complete control was obtained with concentrations of 0.3 per cent., under favourable conditions and 0.5 per cent., under less favourable conditions. Rhizomes down to one foot in depth were killed by 0.25 per cent., but some of the deeper rhizomes may send shoots to the surface about 2 months later and these may require a second but reduced application. The weed has been successfully killed at all stages of development but if the weed is fully grown and in the flowering stage (when it attains a height of $1\frac{1}{2}$ –2 feet) more liquid is required thoroughly to wet the leaves. For this reason it is preferable to treat the weed when it is 6–10 inches high and before flowering has commenced i.e., prior to November although satisfactory results are obtained later providing the plant is not allowed to produce seeds which later set up a new infestation.

Almost equally good results have been obtained with Sodium Chlorate. One spraying with 10 per cent. chlorate solution gave an 80–90 per cent. kill of plants including rhizomes and a second application to those few plants which survive the first application gave complete control. For the most efficient result with chlorate the plants must be large with a good expanse of leaf surface to absorb the chlorate, and the aerial portions should be thoroughly wetted.

Artemisia vulgaris (Herbe or Brede Chinois, Herbe du Vin, Herbe Rhum).— This weed is not unlike Herbe Solferino in its growth form and general appearance and is found in association with the latter in the Plaines Wilhems region. In general, however, it attains its maximum growth in the higher rainfall districts in soils more or less free from rock and gravel. In such an environment it frequently occurs in almost pure stand and its rhizomes form a dense matrix in the soil to a foot or 18 inches depth. Samples from areas of 1 square metre taken from a luxuriant growth of Herbe Chinois in a cultivated field gave the following results.—

Fresh weight of aerial shoots per arpent =				9.7 tons (Dry weight 1.16 tons).	
do	do	rhizomes	do	= 13.6	do (Dry weight 3.63 tons).
Total fresh matter per arpent =				= 23.3 do (Dry matter 4.79 tons).	
Nitrogen content, per cent. Dry Matter, Tops 1.76 per cent. Rhizomes 0.52 per cent.					
K ₂ O	do	do	do	do	2.27 per cent. do 1.73 per cent.
P ₂ O ₅	do	do	do	do	0.63 per cent. do 0.45 per cent.
Total Nitrogen contained in the weed on an arpent basis = 39.3 kilos					
Total K ₂ O	do	do	do	do	= 89.1 do
Total P ₂ O ₅	do	do	do	do	= 23.7 do

From these figures it is apparent that the weed is an avid feeder and that the cane crop must be deprived of very appreciable quantities of mineral substances. In addition the density of rhizomes in the superficial soil cannot fail to exercise a deleterious effect on cane roots.

A very large number of experiments on the control of this weed have been carried out as the weed is a "borderline" case in its reactions to M.C.P.A. and D.C.P.A. weed killers. Results have varied considerably according to the environment and the stage of growth of the weed. Without describing in detail the experiments carried out, the conclusion is that a considerable degree of control can be effected by M.C.P.A. and D.C.P.A. in fairly high concentration. The most successful results were obtained with the D.C.P.A. preparation called "Weedone". This gave a control of 70–80 per cent. when used at a concentration of 0.5–0.75 per cent. Control is higher in "clean" interlines and considerably less in those interlines on which the weed has been heaped in previous weedings. This difference in the effectiveness of control on "clean" and "weed-heaped" interlines applies to most of the weed species investigated.

By far the most effective method of controlling this weed, however, is by the use of 10 per cent. Sodium Chlorate. Under favourable conditions a death-rate of 90–95 per cent. of tops and rhizomes has been obtained by only one application : the surviving plants being killed later in a second spraying application in which the spraying is confined to the surviving shoots only. In this manner complete control can be effected at a cost of Rs. 36–50 per arpent.

The only justification for using the M.C.P.A. or D.C.P.A. treatment at 0.5–0.75 per cent. against this weed would be in the case of its being desired to kill the weed in growing cane plantations.

Mikania scandens (Liane Margoze, Liane Pauline or Liane Raisin).—This weed has no rhizomatous system but has the capacity of quick vegetative propagation from every node of the trailing stems. If allowed to develop unchecked it would soon envelop the cane in a thick canopy effectively shutting out light. Some interesting observations on the rapid spread of this weed through the river systems were made in the detailed weed survey of the districts where it occurs. In the preliminary experiments it proved to have considerable resistance to M.C.P.A., though certain physiological effects such as gall and adventitious root formation were very marked. In later experiments it was killed by applications of M.C.P.A. at 1.5 per cent. (15 lbs per acre). It proved, however, to be so susceptible to Sodium Chlorate that there is no doubt whatsoever as to the most economic method of controlling this weed. It can be eliminated completely by one spraying operation using 5 per cent. Sodium Chlorate at 100 gallons per arpent. The efficacy of this method is so high that no concern is felt concerning this weed in sugar-cane plantations. A density of Liane Margoze of 17 tons fresh matter per arpent, equivalent to 1.52 tons of dry matter and containing 11.9 kilos of P_2O_5 , 70 kilos of K_2O and 26 kilos of N, was a rotting mass ten days after a single application of 5 per cent. Sodium Chlorate.

Tridax procumbens (Herbe Caille).—This weed is listed as a nuisance weed particularly in the dry areas of the north of Mauritius. No experiments on the control of this weed have yet been carried out.

Bidens pilosa (Ville Bague).—This annual weed reproduces very actively by means of seeds and there is a high population of plants in cultivated land almost throughout the year. It is killed by practically all the weed killers tested.

In the young stage it is quickly killed by 0.1 per cent. M.C.P.A. or D.C.P.A.; in the adult stage abundant galls and stem swellings are produced by these substances and the plant is rendered innocuous though such plants may survive. With 0.2–0.25 per cent. even large fully mature plants are quickly killed. This weed is also killed by the D.N.O.C. compounds at 1 per cent. concentration, ammonium D.N.O.C. and D.N.O.C. suspension being more active than Sodium D.N.O.C.; and by Copper Chloride and Sodium Chlorate at 2.5–5.0 per cent. At current prices spraying with 0.1 per cent. M.C.P.A. is the cheapest chemical method of destroying the weed, the cost being Rs. 15 per acre.

Ageratum conyzoides (Herbe Bouc).—This annual weed has a similar status to Ville Bague and is destroyed in the same manner. It is possibly somewhat more resistant to M.C.P.A. than Ville Bague but 0.2 per cent. has generally given good control.

Siegesbeckia orientalis (Herbe Flacq).—Is of similar status to the above two weeds but is somewhat more resistant to M.C.P.A. 0.2–0.4 per cent. gives complete control. It is killed completely by the D.N.O.C. compounds at 1 per cent. and by the proprietary products "Denoc," "Denocate" and "Denoxylon" at the rates recommended by the manufacturers.

Elephantopus scaber (Herbe Moka) and *Blumea lacera*.—No information on the reactions of these weeds to chemical weed killers is available at present.

Conyza lineariloba (Herbe Gandia).—This weed is killed at all stages by spraying with 0.1–0.2 per cent. M.C.P.A. or D.C.P.A. It is killed when young by the D.N.O.C. compounds but the basal part of the stem of woody, mature plants, frequently survives treatment with D.N.O.C. compounds.

Lactuca indica, *Sonchus oleraceus*, *Sonchus asper*.—(collectively known as Lastron or Laitron).—These species are susceptible to treatment with M.C.P.A. and D.C.P.A. being killed completely in the young stages of growth by 0.1–0.2 per cent. Mature plants may show marked curvatures, swellings and gall formation but may survive though in an innocuous condition. Higher dosages will kill even mature plants. Young plants are also killed by D.N.O.C. compounds and by the proprietary activated forms of these compounds but for mature plants two to three times the usual concentration of these substances is required otherwise the basal portion of the stem may produce new shoots which can sometimes flower and set seed.

While present in cane fields almost all over the island, these weeds are particularly troublesome in certain areas of the Savanne District,

Parthenium hysterophorus (Herbe Blanche).—In spite of its being an annual and easily eradicated by cultural methods, this weed is of considerable importance in the drier parts of the island, particularly in the North. It is easily controlled by M.C.P.A. at all stages of growth being killed in the younger stages by a single spraying with 0.1 per cent. while large fully grown plants may require 0.2–0.25 per cent. It was noted in experiments on this weed that applications of 0.2–0.25 per cent. inhibited germination of the seeds for 2 months or more. Concentrations of 0.05–0.10 per cent. while killing the existing plants, did not prevent further seeds from germinating.

Summary of results for the Compositæ.—Satisfactory methods of control are now available for all the Composite weeds of any importance. The rhizomatous members of this family are the most noxious but even these are multiplied to a considerable extent by seed dispersal though dispersal by human agency such as cutting and transporting the weed for cattle feed (Liane Margoze, Herbe Solferino and Herbe Chinois) or for edible purposes (Herbe Chinois) and the use of improperly prepared manure containing viable parts of the plant has probably contributed appreciably to the dispersal of these weeds.

The necessity of treating these weeds before seed-formation occurs is particularly important if recurrent expenditure on their eradication is to be avoided.

Boraginaceæ

Cordia macrostachya (Herbe Condé).—This shrubby weed has become prominent in view of its remarkable spread into all uncultivated areas and frequently into cane fields, pasturages and aloe fibre plantations. It is an introduced species which, in the absence of natural enemies, and in conditions eminently suitable for its dispersal has quickly achieved dominance in the secondary vegetation of the island.

Unfortunately it has also proved resistant to all forms of chemical control available hitherto. It has been the subject of more experimentation than any other weed during the year under review. The difficulty lies in the tenacity with which life persists in the rootstock and the rapidity of production of new shoots even when all the aerial parts of the plant have been destroyed.

Reactions to applications of M.C.P.A. and D.C.P.A. are striking—the leaves undergo marked epinasty, the leaves—commencing with the older ones become bright yellow and die after a few days. With high concentrations the shoots are completely defoliated, terminal growth ceases and there may be a die back of the stem for varying distances from the apex. Sooner or later buds on the undamaged part of the stem sprout giving rise to abnormal leaves. With low concentrations of hormone weed killers the abnormal leaves show an irregular distribution of chlorophyll, the margins of the leaves being abnormally serrated and deep green in colour whereas the central portion of the leaf is yellowish with very little chlorophyll. Venation of the leaves is also affected. As the leaves grow chlorophyll appears in irregular patches in the central chlorotic region and the leaf gradually approaches the normal type.

With high applications of M.C.P.A. and D.C.P.A. weed killers when the stems are killed back for considerable distances basal buds give rise to leaves which although normal in colour are abnormal in shape. The midrib divides into two, three or more veins giving rise to a bi, tri, or multilobed leaf very far removed from the normal leaf.

Growth takes place in the underlying cortical tissues of the stem and cortical tissue pushes out through the lenticels in the form of pustules which eventually fuse together giving a scab-like appearance to the stem. Finally the bark may split open under pressure from the growing tissues below and in moist weather copious adventitious roots may develop from this gall tissue.

In spite of all these abnormalities the plant is not killed, the root stock is, seemingly, unaffected and later gives rise to new shoots.

Repeated applications of high concentrations of M.C.P.A. and D.C.P.A. have invariably failed completely to destroy the plants.

Concentrations of 0.05 per cent. to 1.5 per cent. have been applied in the cool months and in the warmer months. These substances, therefore, hold no promise for the destruction of this weed. This conclusion is confirmed by the fact that even small seedlings of Condé 1–3 inches high were not killed by concentrations of M.C.P.A. up to 0.5 per cent.

So far as leaf damage is concerned Condé is particularly susceptible to the D.N.O.C. compounds, particularly Ammonium D.N.O.C. but the root stock and lower parts of the stem are unaffected even by repeated applications of 4 per cent. concentration.

When Condé occurs in mixed association with Herbe Tourterelle (*Wikstræmia viridifolia*) the Condé can be suppressed by repeated sprayings with Ammonium D.N.O.C. and Herbe Tourterelle which is much more resistant to this substance becomes the dominant weed. On the other hand if such a mixed association is sprayed with Copper Chloride—the Herbe Tourterelle—which is more susceptible to this substance is suppressed, and the association becomes a pure stand of Condé.

While these facts are of ecological interest they do not contribute to the problem of controlling Condé as Herbe Tourterelle is also extremely difficult to eradicate economically by chemical means. The most useful chemical for use against Condé is Sodium Chlorate and the weed can, in fact, be controlled by repeated spraying with 10 per cent. Sodium Chlorate.

The most effective control method available is to cut the Condé plants at ground level, wait until the new shoots are 6–8 inches high and spray them with 10–20 per cent. Sodium Chlorate. This spraying operation may have to be repeated two or three times before all the plants are killed. This method is not economically practicable at present in view of the high price of Sodium Chlorate and the fact that Condé can be grubbed out by hand labour at a cost of Rs. 80–100 per arpent.

Further experiments will be made when other chemical weed killers become available and experiments on the control of the weed by periodic burnings with a flame throwing lance are also envisaged.

Cynoglossum rochellia.—This herbaceous annual weed is easily eradicated by cultural methods. It is completely killed at all stages of growth by spraying with 0.1 per cent. M.C.P.A. and is also easily killed by the D.N.O.C. compounds and by the proprietary products 'Denoc,' 'Denocate' and 'Denoxylon' at the rates recommended by the manufacturers.

Convolvulaceæ

Ipomea coccinea (true Liane Patate).—No observations on the reactions of this species have been made to date.

Ipomea cairica (Liane lastique).—This weed is extremely susceptible to M.C.P.A. and D.C.P.A. and is completely killed by applications of 0.1–0.2 per cent. D.N.O.C. compounds do not result in complete eradication though they produce a marked scorching effect.

Convolvulus *sp.* (Liseron) was completely killed in one experiment by concentrations of 0.2 per cent. or more M.C.P.A.

Cuscuta reflexa and other *Cuscuta* *sp.* (Cuscutae).—Both these species of *Cuscuta* were killed by concentrations of 0.2–0.5 per cent. M.C.P.A. When growing on valuable host plants, the reactions of the host plant should first be determined as it may also be killed by the hormone.

Rubiaceæ

Pæderia fætida (Liane Lingue, Liane K.K.).—This copiously branched shrubby climber is rapidly threatening to become the worst cane field weed in the rocky soils of Mauritius and is already a most serious pest in the dry and intermediate rainfall districts. It develops most profusely in stone walls and stone heaps although it can also be a serious weed even in free soils. A large proportion of Mauritius sugarcane plantations have walls consisting of the rocks which have been removed from the soil to make cane planting possible. In the rockiest areas such walls occupy all alternate interlines. These walls become heavily infested with Liane lingue from which it encroaches into the rock free areas of the field twining around the cane and finally strangling the cane if allowed to grow unchecked. It is chiefly because of this weed that these walls have to be pulled down and re-erected in the adjacent interlines every time a field is replanted, otherwise it becomes impossible to control the weed by ordinary weeding methods and yields suffer accordingly. This operation of re-erecting walls has become an expensive item and the control of Liane Lingue in order to make this operation unnecessary has become an urgent problem.

Together with Herbe Condé and Herbe Chinois, this weed has been subject to more experimentation than most of the other bad weeds. Work on methods of control has been in progress throughout the year. The initial trials included treatments with the D.N.O.C. compounds, Copper Chloride and Sodium Chlorate. These substances produced a good scorching effect on the exposed shoots but re-growth was very rapid. Surprisingly, Sodium D.N.O.C. was more active against this weed than Ammonium D.N.O.C. and the D.N.O.C. suspension. Sodium Chlorate was, however, the most efficient but even after Sodium Chlorate re-growth is fairly rapid.

Experiments carried out in the cool winter months with M.C.P.A. in the liquid form at 0.05 per cent. and 0.1 per cent. and in the solid form (as agroxone containing 1 per cent. M.C.P.A.) at 50 and 100 kilos per arpent showed initial promise—the aerial parts being completely killed in 4–6 weeks until the walls were bare. Soon afterwards there was regrowth from the stems—many of the new leaves being quite abnormal. They showed fluted margins and irregular development of chlorophyll. Regrowth was luxuriant after these applications of M.C.P.A. but was much slower after spraying with 20 per cent. Sodium Chlorate.

Further experiments were carried out with higher concentrations of M.C.P.A. during the cool months but even with concentrations of 0.25 per cent. applied at 200 gallons per arpent regrowth was active. Concurrently with these experiments at Réduit experiments were carried out on estates in the hotter parts of the island to determine whether a better response could not be obtained under the latter conditions. These were carried out at Mon Désir S.E., Black River, Beau Séjour S.E., Mapou, and Savinia S.E., Grand Port. At Savinia M.C.P.A. was compared with D.C.P.A. and mixtures of the two substances were used. The forms of M.C.P.A. available were liquid "Methoxone," "Phenoxyl" and solid 'Agroxone' and D.C.P.A. in the form of the pure acid (Chloroxone) and in the American proprietary form Weedone.

In these experiments although a complete kill of exposed shoots was obtained by 0.2 per cent. M.C.P.A. or D.C.P.A.—regrowth was even more rapid and had even commenced on some shoots before the effects of the hormones were complete on other shoots, i.e., in 3–4 weeks. Sodium and Ammonium D.N.O.C. at 2 per cent. strength and "Denoc" and "Denocate" at two and three times the concentration recommended by the manufacturers failed to do more than scorch the shoots and regrowth had commenced within 7–10 days.

Experiments with concentrations of M.C.P.A. up to 0.25 per cent were repeated using glycerine at 5 per cent. and 10 per cent. in the spraying liquids and molasses at 10 per cent. and 20 per cent. It was hoped that the addition of these substances would delay evaporation of the sprayed liquids from the leaves and so possibly result in greater absorption. The results were negative; if anything, the addition of these substances resulted in a reduced efficiency of the M.C.P.A.

Further experiments on Liane Lingue growing in walls were laid out at Réduit and at Savinia S.E. in which concentrations of 0.5 per cent. to 1.5 per cent. M.C.P.A. and D.C.P.A. were used and experiments were made at Beau Champ S.E. and Rose Belle S.E. on Liane lingue growing in free soils using concentrations up to 1.5 per cent. In addition a proprietary product known as 'Denoxylon' which is a mixture of M.C.P.A. with activated D.N.O.C. compounds was tried at concentrations up to four times the rate recommended by the manufacturers.

It was found that *Liane lingue* growing in free soils could be killed completely by a concentration of M.C.P.A. of 1.5 per cent. A certain number of plants in free soils at Rose Belle were killed by 0.5 and 1.0 per cent. In walls about 4 feet high by 3 feet wide at Réduit the weed was not destroyed even by spraying with 1.5 per cent. M.C.P.A. These latter experiments were done in the hot season and there was a considerable amount of regrowth after 4-5 weeks.

At Savinia, where the walls were only 1-2 feet high spraying with M.C.P.A. at concentrations up to 1.5 per cent. and with D.C.P.A. (in the form of Weedone) also at concentrations up to 1.5 per cent. together with repeated sprayings of M.C.P.A. at 0.15 per cent. failed to kill the weed completely and in areas where the weed was growing directly in rocky soil it was not killed, the basal part of the stems and the rhizomes remaining viable. There was no noticeable difference in efficiency between M.C.P.A. and D.C.P.A.

It is apparent from these results that *Liane lingue* is a border-line case so far as the possibility of its control by M.C.P.A. and D.C.P.A. is concerned. In free soils it can be killed at high concentrations but it is very doubtful whether at present prices the application of this method would be justified. Where it is well-established in walls it is almost impossible to eradicate even with high dosages of the hormone. If the less ambitious aim of suppressing the weed is the object, this can be achieved by monthly spraying with any of the D.N.O.C. compounds at 1 per cent. M.C.P.A. or D.C.P.A. at 0.2 per cent. or with Sodium Chlorate at 10 per cent. The action of the hormones and of Sodium Chlorate is more prolonged than the D.N.O.C. compounds.

While it is expected that the weed could finally be killed by a large number of repeated sprayings, this would be difficult to achieve in practice owing to the difficulty adequately to spray the walls when the cane leaves themselves cover the walls. Moreover, the shade cast by the cane leaves does not result in appreciable suppression of the weed as it can survive intense shade. It is in fact found as a ground species in dense thickets of Condé, etc., in uncultivated land.

If it should prove economically practicable, the best treatment would probably be the use of high concentrations of M.C.P.A., D.C.P.A. or Sodium Chlorate in the eradication of the weed in areas of the fields free from walls, followed by erection of the walls on these areas and subsequent destruction of the weed by the same procedure in the areas previously occupied by the walls. It is believed that the weed could be eradicated from fields by this method but there is little doubt that heavy expenditure would have to be incurred in carrying out the operation. There still remains the possibility of the fields being re-infested by seeds dispersed in the excreta of birds unless steps were taken to suppress the weed and so prevent seed formation. Experiments to test the feasibility of eradication of the weed by the above procedure and to determine the extent of reinfestation are envisaged for the near future.

As a point of interest examinations were made of attempts by two estates—one in the Black River District and one in Grand Port—to control *Liane lingue* on stone heaps by artificial infestation with a *Cuscuta* species. The parasite considerably reduced the growth of the weed but complete control was not obtained as the *Liane lingue* had a greater growth capacity than the *Cuscuta* and was continuously growing away from it.

An effective and cheap method of destroying *Liane lingue* thus still remains an urgent desideratum.

Acanthaceæ

Asystasia gangetica (Herbe pistache, liane pistache, Herbe piment). This weed becomes a bad weed in certain restricted localities particularly in the Savanne District.

It is satisfactorily controlled (90–95 per cent. destruction) by any of the D.N.O.C. compounds at 1 per cent. concentration and by Copper Chloride at 5 per cent. concentration. It is completely eradicated by spraying with M.C.P.A. at 0.15 per cent. concentration. There have not been adequate supplies of D.C.P.A. to test against this weed. Solid M.C.P.A. (agroxone) applied at 150–200 kilos per arpent also completely destroyed the weed.

Thunbergia fragrans (Liane blanc).—This weed is by no means a serious weed. It is completely killed by one application of M.C.P.A. at 0.20 per cent.

Schrophulariaceæ

Striga hirsuta (Herbe Feu, or Herbe Feu à fleurs rouge).—The addition of the phrase “with red flowers” is to distinguish this plant from the grass Mackaye (*Phalaris arundinacea*) which is also frequently referred to as “Herbe Feu”.

This weed is of interest in that it is a partial parasite on the roots of Sugarcane and Maize (as well as other Gramineæ) and may thus cause appreciable reduction in the yield of cane in heavily infested areas. It was completely destroyed by spraying with 0.15–0.2 per cent. M.C.P.A.

Aroideæ

Alocasia macrorrhiza (Songe blanc or Songe sauvage).—This plant is an important weed in the wet districts. It produces new leaves quickly after treatment with D.N.O.C. weed killers, Copper Chloride and Sodium Chlorate. Its initial reaction to spraying with M.C.P.A. is very striking—the petioles of the leaves undergo violent curvatures the leaf blades finally resting on the ground where they rapidly rot. After one or two months there is a formation of new but dwarf leaves from the crown of the plant and these are killed by a subsequent application of M.C.P.A. The plant may survive in an attenuated form but it is considered that the degree of suppression obtained by two sprayings with 0.25 per cent. M.C.P.A. amounts, in practice, to a satisfactory control.

Plantaginaceæ

Plantago lanceolata (Plantain, or Herbe Caroline).—This weed flourishes in Mauritius on poor or relatively poor soils. It reproduces rapidly from seed. In the young stage a satisfactory degree of control may be obtained by spraying with any of the D.N.O.C. compounds at 1–2 per cent. Larger plants survive this treatment and regeneration, even from roots, is frequent. The weed is completely destroyed by M.C.P.A. and D.C.P.A. at 0·1–0·2 per cent. concentration though complete death of the plants may frequently not occur for one month to six weeks after the treatment has been applied. 10 per cent. Sodium Chlorate also gives good control but is not so efficient as the hormone weed killers for this weed.

Thymelaceæ

Wikstræmia viridifolia (Herbe Tourterelle).—This shrubby weed attains local importance as a bad weed in certain rocky soils particularly in the drier and warmer districts. It has been displaced from its position in the vegetation sequence by Herbe Condé with which it is often found in association as a subordinate species. It reacts in a similar way to Condé to the M.C.P.A. and D.C.P.A. weed killers—losing some or all of its leaves, the stem being little affected. It is also resistant to all the contact weed killers available—the D.N.O.C. compounds, Copper Chloride and Sodium Chlorate, though its leaves are rapidly killed by Copper Chloride. It was killed in experiments wherein it was cut at soil level and the cut stump of the stem immediately daubed with a small mop with a saturated solution of Sodium Chlorate, there being no regeneration from the root stock following this treatment. This method is hardly applicable on a large scale and a satisfactory practical means of control is still not available.

Bignoniaceæ

Bignonia unguis-cati (so-called Liane patate, Patte de poule piquant).—This weed has not been included in the “bad” weeds simply because its distribution is still very restricted, being confined to a few areas in Black River district and the North. It is apparently a plant that has escaped from cultivation and has undoubtedly all the attributes of a really bad weed. It is a creeping liane flourishing on stone walls and on stone heaps and also in free soils where it forms a canopy over all vegetation even over tall trees. Below ground it has two or more tubers which may be located at considerable depth and which produce new shoots when the aerial parts of the plant are destroyed.

Preliminary trials with 0·10 per cent. M.C.P.A. in the liquid form and with the solid form at 100 kilos per arpent resulted in destruction of the aerial shoots but there was a rapid regrowth following the death of the aerial shoots.

In subsequent experiments carried out in the Black River District drenching sprays of M.C.P.A. at 0·25 per cent. and 0·50 per cent. and Sodium Chlorate at 10 per cent. were used in order to penetrate the thick growth. For this 200 gallons per arpent of solution was necessary. The M.C.P.A. treatments produced an effective kill of the aerial shoots,

particularly at 0·5 per cent. but even at this concentration there was an appreciable amount of regrowth and the tubers were not killed. The Sodium Chlorate produced excellent results, on the aerial portions, giving a quick and complete kill. The vascular system of the tubers developed a brownish colour and the vascular elements became blocked. The tubers subsequently dried out and rotted.

Spraying with 10 per cent. Sodium Chlorate proved to be the most efficient and economic method of destroying this weed.

Verbenaceæ

Lantana camara (Vieille Fille).—There are two forms of this shrub in Mauritius one with pink flowers and one with orange flowers. It has been shown that there is a remarkable difference in the susceptibility of these two forms to treatment with M.C.P.A., the pink form being much more susceptible. On treatment with 0·2 per cent. M.C.P.A. in the cooler winter months the pink-flowered form was killed completely and while several shoots died back for a certain distance the orange-flowered form recovered. In the cool months a concentration of 0·5 per cent. was required to kill the latter type.

Experiments performed during the hot weather on larger bushes with a main stem 1–1½ inches in diameter gave somewhat less satisfactory results—some re-growth taking place from the base of the stem even after spraying with 0·5 per cent. A second application may be necessary to completely kill large bushes.

Verbena officinalis (Verveine).—This annual weed although easily eradicated by cultural means becomes a nuisance in certain localities in view of its vigorous growth. It is killed in the young stage by the D.N.O.C. weed killers but when in the shrubby mature form a considerable amount of regrowth occurs from the base of the stem following these treatments. It was killed completely by M.C.P.A. and D.C.P.A. at 0·2 per cent. at all stages of growth.

Verbena bonariensis (Verveine sauvage).—No information on the reactions of this weed available.

Stachytarpheta indica (Herbe Queue de Rat).—This weed is completely destroyed by treatment with 0·15–0·20 per cent. M.C.P.A.

Leguminosæ

Acacia concinna (Sappan, Chikakai).—This prickly shrub or small tree is particularly troublesome in the drier districts where owing to its extensive underground runners or rhizomes it spreads at an appreciable rate. It proved resistant to M.C.P.A. at concentrations of 0·1–0·3 per cent. but was very susceptible to Sodium Chlorate. It has been killed in several experiments with one spraying operation with 10–15 per cent. Sodium Chlorate. Sodium Chlorate spraying is undoubtedly the most economic method for the destruction of this weed.

Mimosa pudica (Sensitive).—This weed although extensively distributed attains prominence as a weed chiefly in the lower regions of Grand Port where it is frequently found in almost pure stand. It is extremely resistant to M.C.P.A. and D.C.P.A. being almost unaffected by concentrations of up to 0.5 per cent. and not killed even by 1.5 per cent. It is also resistant to the D.N.O.C. weed killers including 'Denoc,' 'Denocate' and 'Denoxylon.'

Experiments on the use of Sodium Chlorate in the destruction of this weed are to be carried out shortly.

Medicago denticulata (Luzerne Sauvage).—This weed is easily killed being extremely susceptible both to the D.N.O.C. weed killers and to M.C.P.A. and D.C.P.A. It is killed by the D.N.O.C. weed killers at 1.0 per cent. and by the hormones at 0.15–0.2 per cent.

Melilotus alba and *Melilotus indica* (Melilot blanc and Melilot jaune respectively).—These weeds are easily killed by the D.N.O.C. weed killers and by the hormones M.C.P.A. and D.C.P.A. at the same concentrations as *Medicago denticulata*.

Vicia sativa (Lentille sauvage).—Was killed by M.C.P.A. and D.C.P.A. at 0.1 per cent.

Rosaceæ

Rubus rosafolia (Petite Framboise) and *Rubus roridus* (Framboise Marronne).—These weeds are resistant to M.C.P.A. and D.C.P.A., merely shedding a certain number of the lower leaves as a result of treatment with these substances. Regrowth is rapid also after treatment with D.N.O.C. compounds and Sodium Chlorate which results in death of the aerial parts only.

Euphorbiaceæ

Euphorbia peplus (Herbe Lait) —This annual weed grows with amazing rapidity in the cane fields particularly in the cool winter months. It is killed with ease in the young stage and with more difficulty when mature, by the D.N.O.C. compounds, D.N.O.C. suspension, Denocate and Denoc being more effective than Ammonium D.N.O.C. and the latter, in turn, being considerably more effective than Sodium D.N.O.C. It frequently survives spraying with 0.05–0.10 per cent. M.C.P.A. but is killed at all stages by spraying with 0.2–0.25 per cent.

Euphorbia hirta (Jean Robert), and *Euphorbia thymifolia* (Petite Rougette).—These weeds show considerable resistance to M.C.P.A. and were not killed in many experiments by concentrations of up to 0.5 per cent.

On the other hand, they are easily killed by the contact weed killers —Sodium Chlorate or D.N.O.C. compounds.

Phyllanthus urinarea (Kirkmanelli)—Is killed easily by the D.N.O.C. compounds including the proprietary activated forms. Proved somewhat resistant to M.C.P.A. but is killed by concentrations of 0.5 per cent. or over.

Acalypha indica (Herbe Chatte).—This weed is hardly affected at all by concentrations of M.C.P.A. and D.C.P.A. up to 0·5 per cent. It is killed by 2 per cent. Ammonium D.N.O.C. or D.N.O.C. suspension and by 10 per cent. Sodium Chlorate.

Oxalidaceæ

Oxalis corymbosa (Oseille, trèfle) and *Oxalis corniculata* (Oseille filante).—The former of these weeds is plentiful in cane fields in almost all localities and almost aspires to the rank of a bad weed. It does not, however, appear to have any marked deleterious effect on the cane. The leaves are killed by M.C.P.A. and by the D.N.O.C. compounds but the bulbils are not affected even when applications of M.C.P.A. at concentrations of up to 0·5 per cent. are made. It can be suppressed by two or three applications of M.C.P.A. or D.C.P.A. at 0·15–0·2 per cent. but it is doubtful whether it would be economically worth while. *Oxalis corniculata* is considerably more resistant to M.C.P.A. than *O. corymbosa* and applications of up to 0·75 per cent. have failed to control this weed.

Amaranthaceæ

Alternanthera sessilis (Brède Emballage, Serenti).—This weed is of considerable importance in the District of Grand Port where it has invaded considerable areas. It is not easy to remove completely in ordinary cleaning operations. It regrows rapidly after treatment with the D.N.O.C. compounds and the activated substances Denoc and Denocate. Over 90 per cent. of the plants were killed outright by a single spraying with M.C.P.A. at 0·2 per cent. concentration and a 100 per cent. kill was obtained with 0·4 per cent. M.C.P.A. The pure D.C.P.A. in the acid form was much less effective at equivalent concentrations.

Amaranthus caudatus (Brède Malabar).—No information on this weed are available at present.

Papaveraceæ

Argemone mexicana (Chardon, Chardon du pays).—This weed was completely destroyed at all stages by the D.N.O.C. weed killers at 2 per cent. and by the proprietary activated D.N.O.C. substances at double the standard rate. It was also killed completely by M.C.P.A. and D.C.P.A. at 0·2 per cent. concentration.

Miscellaneous weeds on which some information has been obtained

Commelyna benghalensis (Herbe Cochon) and *Commelyna communis* (Herbe Cochon petite espèce).—Were killed by applications of 0·2 per cent. M.C.P.A.

Litsea glutinosa (Bois d'Oiseaux).—Is resistant to concentrations of 0·05–0·20 per cent. M.C.P.A. Is killed by 10 per cent. Sodium Chlorate and by D.N.O.C. compounds at 2 per cent. concentration.

Sida acuta (Herbe Panier).—Killed by 0·2 per cent. M.C.P.A. and D.C.P.A.

Enothera rosea.—Killed by 0.25–0.50 per cent. M.C.P.A.

Cardiospermum helicacabum (True Liane Poc Poc, Bonnet de Prêtre).—Was killed by one application of 0.30 per cent. M.C.P.A.

Jussiaea suffruticosa (Gandia marron, Herbe Joséphine, Herbe La Mare).—Was killed completely by one application of 0.25–0.30 per cent. M.C.P.A. but not by 0.1 per cent.

Acanthospermum hispidum (Tricorne).—Was killed in one experiment by M.C.P.A. at 0.2 per cent. Further experiments on the selective control of this weed are to be carried out shortly as the weed is an important pasture weed in the island of Rodriguez.

Solanum nigrum (Brède Martin).—Is resistant to M.C.P.A. and has not been killed by concentrations up to 0.5 per cent. It suffers appreciable damage at concentrations of 0.3–0.5 per cent. Regenerates new shoots from the base of the stem after treatment with D.N.O.C. compounds.

Lobelia cliffortiana (Brède mam'zelle).—Is killed by 0.2 per cent. M.C.P.A. and by the D.N.O.C. compounds at 1 per cent. concentration.

Anagalis arvensis (Mouron).—Is killed by 0.2 per cent. M.C.P.A. and by 1 per cent. D.N.O.C. (suspension and ammonium salt).

Passiflora suberosa (so called Liane Poc Poc).—Is extremely resistant to M.C.P.A. and D.C.P.A. and regenerates after contact herbicides.

Borreria ocymoides.—Is killed by 0.3–0.5 per cent. M.C.P.A. and D.C.P.A. Takes longer to die in the seedling stage than in the mature stage.

Sisyrinchium chilense.—Killed by the D.N.O.C. compounds at the usual rates and by M.C.P.A. at 0.1–0.2 per cent.

Milla borbonica (Ail Sauvage).—Is resistant to M.C.P.A.: contact weed killers such as D.N.O.C. and Sodium Chlorate destroy the leaves but fail to destroy the bulb.

Ligustrum walkerii (Privet).—The Privet has become established in the forests and scrub of the uplands where it makes luxuriant growth. It proved very susceptible to M.C.P.A. being killed completely by one application of 0.20 per cent. concentration.

Control of weeds in lawns

During the winter months when growth of lawn grasses is considerably reduced, lawns in the uplands of Mauritius contain large quantities of weeds which rapidly colonize all areas where the growth of the grasses is weak. Experiments were carried out on such lawns at Réduit. The chief weeds present were *Hydrocotyle sibthorpioides* (petit Boileau), *Hydrocotyle asiatica* (Boileau), *Oxalis corniculata* (Oseille filante, or Alléluia à fleurs jaunes), *Apium leptophyllum* (Anis Sauvage) *Indigofera endecaphylla*, *Desmodium* sp., *Kyllingia monocephala*, *Plantago lanceolata*. Treatments applied were 2 per cent. and 4 per cent. Copper Chloride, D.N.O.C. suspension, Ammonium D.N.O.C. and Sodium D.N.O.C. all at 1 per cent. M.C.P.A. (liquid) at 0.05 per cent. 0.1 per cent. and 0.15 per cent. and M.C.P.A. (solid) at 100 kilos and 200 kilos per arpent.

Best results were obtained with M.C.P.A. which killed a large number of the weeds without affecting the grasses. In these experiments also, better results were obtained with M.C.P.A. solid at 200 kilos per arpent than any of the liquid M.C.P.A. concentrations. The two *Hydrocotyle* species, *Apium*, *Indigofera*, *Desmodium* and *Plantago lanceolata* were killed. *Oxalis corniculata* although damaged was not killed and even the high dose of 500 kilos solid M.C.P.A. (agroxone) per arpent failed to destroy this weed although it was seriously damaged. Treatment with M.C.P.A. followed by a top dressing of fertilizers (such as Ammonium Sulphate) to encourage grass growth is likely greatly to improve the quality of lawns in the winter months.

General Conclusions based on the results of experiments on Weed Control

There is little doubt that the weed killing hormones M.C.P.A. and/or D.C.P.A. are likely to be of considerable value for the destruction of many of the noxious weeds present in cane plantations in Mauritius. They are by no means a panacea for the eradication of all weeds. A knowledge of the weeds which are affected or killed by these hormones is, therefore, a fundamental consideration in the economical application of these substances. It is hoped that the foregoing account will provide a substantial guide for the Planters to base their applications of such weed killers. There is little doubt that the substances will prove of most value in the destruction or suppression of those noxious weeds which are susceptible to their action. It would probably also be practicable to treat susceptible annual weeds such as *Ville Bague*, etc., where these are present in large numbers. Where there are mixed stands of weeds which contain a considerable proportion of *Chiendent*, *Mackaye* or other noxious weeds which are not susceptible to the treatment, it would probably be inadvisable to treat the remaining susceptible species unless the former were removed by cultural methods otherwise their growth may be increased considerably by the removal of competition resulting from the death of the susceptible species.

For those weeds which are not affected by the hormone weed killers, Sodium Chlorate is likely to have a wide application. In addition to being an efficacious herbicide for many of the noxious weeds it would probably be of great value in destroying weeds in such centres of weed dispersal as tramway routes and roads in cane fields from which such weeds as *Chiendent*, *Mackaye*, etc., readily encroach into the fields. At present Sodium Chlorate is expensive and in short supply but should there be a large demand for it there seems to be no insurmountable obstacle to its manufacture locally.

A considerable field for further research lies in the determination of the most efficient and economic methods for the control of the individual noxious weeds under different climatic and soil conditions and the reduction in sugarcane yields caused by varying infestations of the more important weed species. It is against the latter that the costs of eradication or suppression of these weeds must be balanced. Problems of weed control in cane fields are fundamentally different from selective control in cereal crops. Bad weeds must be more or less permanently suppressed or eradicated as the young sugarcane plants may take several

months adequately to shade the ground and suppress weed growth. Once this has happened, a heavy sugarcane crop is in itself one of the most efficient factors in weed control.

Investigations on the use of Organo-mercurial compounds in the pre-treatment of Sugarcane cuttings

Preliminary work on the use of organo-mercurial compounds in the pre-planting treatment of sugarcane cuttings was described in the Sugarcane Research Station Annual Report of 1941. These results were very encouraging and showed that these substances could be used as solutions without a decrease in efficiency—a result of considerable practical importance in the application of the method in Sugarcane agriculture.

Investigations on the use of these substances have been given a high priority in South Africa where the results obtained were so beneficial that the treatment is now rapidly becoming standard practice.

In collaboration with the Plant Pathologist of the Department of Agriculture (Mr. P. O. Wiehe) the writer has been engaged in further investigations on the use of these substances under Mauritius conditions.

A large scale experiment was laid out at Sans Souci S. E. in which the organo-mercurial compounds Aretan, Ceresan, Harvesan, Agrosan G, Verdasan and Abavit were compared with each other and with no treatment for five different varieties, M.134/32, M.171/30, M.165/38, M.63/39 and M.76/39 and with and without the application of 4 tons molasses per arpent applied ten days before planting. Germination counts were made at intervals. All those cuttings which failed to germinate were uprooted and carefully examined by Mr. Wiehe and the cause of failure determined. This disease aspect of the problem provides the explanation for the differences found in percentage germination and possibly in the rate of early growth of the shoots.

The effect of the treatments on the total number of shoots germinated were well marked and are given below—

<i>Treatment</i>	<i>After 6 weeks No. of shoots</i>	<i>After 10 weeks No. of shoots</i>
Controls ...	1,061	2,004
Ceresan ...	1,283	2,743
Harvesan ...	1,209	2,690
Aretan ...	1,528	3,207
Abavit ...	1,310	2,839
Agrosan ...	1,231	2,860
Verdasan ...	1,258	2,814

There was an increase in the number of shoots germinated as a result of all the organo-mercurial treatments, but Aretan was outstandingly the best treatment:

For the individual varieties the increase in number of shoots over the control plots was high in the varieties M.171/30, M.165/38 and M.76/39 and considerably less in the varieties M.134/32 and M.63/39.

It is known that the variety M.171/30 frequently germinates poorly and considerable recruiting has to be resorted to, while M.134/32 is a quick and good germinating variety. These results provisionally place

the newly released varieties M.165/38 and M.76/39 in the same category as M.171/30 and the newly released variety M.63/39 in the same category as M.134/32. Mr. Wiehe's observations indicated that there may be a considerable difference between varieties in their resistance to Pineapple disease—which is one of the important factors in failure to germinate.

It is also significant to note that an increase in the number of shoots germinated was obtained by the application of 4 tons molasses ten days before planting but only in those varieties which also responded well to the organo-mercurial compounds, i.e., M.171/30, M.165/38 and M.76/39 and not in the remaining two varieties. These points are made clear in the following table which gives the percentage increase in number of shoots over the controls.

Variety	% Increase due to Organo-mercurials						Due to Molasses
	Ceresan	Harvesan	Aretan	Abavit	Agrosan	Verdusan	
M. 171/30 ...	20	13	64	18	48	51	17
M. 134/32 ...	13	9	26	29	23	4	—
M. 165/38 ...	87	64	121	121	70	60	9
M. 63/39 ...	8	32	5	2	—	—	—
M. 76/39 ...	100	113	162	118	52	101	9

Complementary to this effect of molasses on germination of the cuttings Wiehe found that the incidence of pineapple disease was significantly decreased in the molasses treated plots. A possible explanation of this action of molasses is its effect in increasing the soil microflora and thus multiplying organisms which suppress the Pineapple disease organism.

The total length of the shoots in certain blocks was determined. From these results it was apparent that Aretan frequently, though not invariably, caused an increase in the length of the shoots. In the variety M.171/30 the mean length of shoot in cms. was 8.50 in the controls and 8.83 in the Aretan treated plots. In M.76/39 the corresponding figures were 9.20 and 11.33. In the other varieties determinations of the length of shoots were vitiated by a marked gradient in soil fertility which became apparent in the blocks as the young plants developed.

A further comprehensive experiment which had been laid down by Wiehe at Réduit included two varieties, M.134/32 and M.112/34, eight treatments viz., Controls; dipped in solid lime; and dipped in solutions of Agrosan, Ceresan and Aretan all at concentrations of 1 per cent. and 2 per cent. Of the four replicated blocks, the first was irrigated but not inoculated, the second irrigated and also inoculated with the Pineapple disease organism, the third was not irrigated and not inoculated and the fourth not-irrigated but inoculated. From the point of view of germination and growth of the young shoots the main conclusions were—

- (1) Aretan was outstandingly the best treatment both under irrigated and under non-irrigated conditions.
- (2) Germination was significantly decreased in the inoculated blocks as compared to the uninoculated blocks only in the controls. In the treated plots inoculation with the Pineapple disease organism had no effect on germination and growth of the shoots.

- (3) Under non-irrigated conditions Aretan was the only substance that promoted good germination: there were indications that under these conditions 2 per cent. Aretan was somewhat better than 1 per cent. Aretan.
- (4) Under irrigated conditions also Aretan was far better than any other treatment but there was no difference between 1 per cent. and 2 per cent. concentration.
- (5) In addition to increasing the number of buds germinated, the average length of shoots in the Aretan treatment was markedly higher than the controls and other treatments, under all the conditions included in the trial.
- (6) Dipping in solid lime was of no benefit under unirrigated conditions but was distinctly beneficial under irrigated conditions. Under the latter conditions the treatment would approximate to a limewater soaking treatment which is known to be distinctly advantageous under Mauritius conditions

Similar observations on number of shoots germinated and on the length of the shoots produced were carried out at Henrietta (Réunion S.E.) where trials were planted at intervals in order to determine the effect of varying climatic conditions on the results obtained. The results are summarized in the table below—

Date of planting	20.8.46		28.8.46		26.9.46		29.10.46	
	No. of shoots	Total length in cms.	No. of shoots	Total length in cms.	No. of shoots	Total length in cms.	No. of shoots	Total length in cms.
Ceresan ...	674	9449 (14'0)	706	8396 (11'9)	289	2768 (9'6)	325	2706 (8'3)
Aretan ...	694	9386 (13'5)	727	8366 (11'5)	549	6146 (11'2)	363	2930 (8'1)
Agrosan ...	664	8998 (13'5)	624	7279 (11'7)	358	3461 (9'7)	394	3361 (8'5)
Controls ...	541	6567 (12'1)	584	5892 (10'1)	265	2697 (10'1)	311	2656 (8'5)

All the treatments have shown a marked increase over the controls. The difference between Aretan and the next best—Ceresan—is not large except in the plantations made on 26th September 1946. Further work on the effects of these substances is now in progress and the results will be reported in due course.

Investigations on growth and accumulation of mineral substances in Sugarcane under field conditions

The initiation of this investigation was mentioned in the 1945 Annual Report and the work has now been substantially completed though a complete analysis of the data cannot be attempted until certain analytical determinations, held up by lack of reagents, have been completed. Composite samples of cane from areas of 1/1,000 arpent on each of three fields bearing 1st, 2nd and 3rd ratoons respectively were taken from 12 representative estates in the different climatic regions of the island. These were brought to the Laboratory where growth measurements were taken and analyses made of sucrose, reducing sugars and soluble non-sugars in the cane, and N, K₂O and P₂O₅ in the millable cane, trash, and green tops (the latter consists of the green leaves plus that immature part of the apex of the cane which is not sent to the

factory). The latter data are complementary to, and serve to supplement, similar data which have been accumulated by the Chemical Division for some time with a view to developing rational control of sugarcane fertilization.

A few interesting points which emerge from the data are described below, and the points mentioned are illustrated in Figures 2-8; a fuller account of the work will be presented elsewhere.

Length, in ratoon canes, is highly correlated with the fresh weight of the cane, but the attainment of the maximum rate of increase in length occurs about one month earlier than the period of maximum increase in green weight, the former occurring in March and the latter in April. The time at which the maximum rate of increase in dry weight occurs is considerably later, at the end of June: this is due to the rapid rate of accumulation of sucrose at this time. Accumulation of sugar was still going on at an appreciable rate (37 per cent. of the maximum) at the beginning of August though the rate of accumulation at this time was falling rapidly.

The rate of increase in the water content of the cane crop expressed on a per-acre basis reached its maximum at the same time as the maximum rate of increase in length of the cane and shows an extremely high correlation with length increments throughout the growth cycle. It had already reached zero value by the beginning of August, i.e., by this time the whole of the water taken up from the soil is lost in the transpiration process and none is retained for the formation of new tissues.

From the beginning of February onwards the amount of entire green tops remains remarkably constant, while, as is well known, the amount of fibre and trash increases steadily. Accumulation of soluble non-sugars follows closely that of sucrose, while the amount of reducing sugars reaches its maximum in June and thereafter falls rapidly.

The percentage of the total dry matter produced in the cane crop which is accumulated as sucrose increases steadily throughout the season. By August the whole of the dry matter accumulated by the cane crop is retained in the plant as sucrose. The following are the values obtained—

*Proportion of the total dry matter
produced which is accumulated
as sucrose*

February ...	11.3 per cent.
March ...	22.8 ..
April ...	35.3 ..
May... ..	45.2 ..
June... ..	49.6 ..
July... ..	96.5 ..

With respect to mineral nutrition, it has been established that the composition of the entire green tops remains remarkably constant and since the actual weight of green tops per arpent also remains constant from the month of February onwards, it follows that the total quantity of N, P and K in this part of the plant is also constant. Under the conditions of growth in this investigation the total quantity of N, P_2O_5 and K_2O per arpent contained in the green tops was 23 kilos, 11

kilos and 67 kilos respectively. In the millable cane and the trash, on the other hand, the three major minerals increase throughout the season though the rate of increase in the period February to April is considerably higher than in the period May to August. In this connection it is interesting to note that the ratoon crop had absorbed 53·5 per cent. of its total nitrogen, 40 per cent. of its P_2O_5 and 45·7 per cent. of its K_2O as the age of three months. This indicates once more the desirability of early fertilization.

The range of total N, P_2O_5 and K_2O removed by the crop on various estates in which the investigation was carried out are given below in kilogrammes.

		<i>Per Acre</i>	<i>Average per ton of cane</i>	<i>Values obtained by the Chemical Division</i>
N	...	33·4– 54·0	1·34	1·61
P_2O_5	...	21·0– 45·3	0·89	0·92
K_2O	...	130·1–228·5	4·81	4·72

The average content per ton of cane compares fairly well with values obtained by the Chemical Division* (in fields where there was little likelihood of there being a deficiency of any of the three minerals), except for a lower nitrogen content. The lower value obtained for Nitrogen in the present investigation possibly signifies that there was, on the average, a slight deficiency of this element. This suggestion is confirmed by the nutritional equilibrium of the ratoon crops investigated which is shown in the triangular diagram below. (Figure 8). On this diagram are also shown the points obtained by the Sugarcane Research Station Chemical Division representing optimum nutritional equilibrium and by experimenters in Hawaii in an experiment where Zero, 50 kilos, and 80 kilos of Nitrogen per acre (equivalent to zero, 0·65 kilos and 1·01 kilos per ton of cane) were applied—maximum yields being obtained with the highest dosage. It is apparent from the diagram that the ratoons in the present experiment were suffering from Nitrogen deficiency.

Field Trials on the relative merits of ridge and furrow planting

Further trials on this subject are being laid down. Experience with one of these trials shows that the conditions immediately after planting may have an important effect on the results obtained. Heavy rains immediately following planting on ridges may wash away part of the soil covering the cuttings which afterwards may dry out in hot sunny weather resulting in poor germination, so that the ridge plantations get an unfavourable start compared to the furrow plantations.

Publications

A series of joint papers with the Senior Chemist on the control of weeds in cane fields were published during the year in the Mauritius Agricultural Review.

H. EVANS,
Botanist.

*Sugarcane Research Station Annual Report, 1944 p. 18.

Key to graphs illustrated in Figures 2 to 8

Figure 2.—Showing total cane production, entire green tops and trash, also sucrose, reducing sugars, soluble non-sugars and fibre, all expressed on the dry weight basis in tons per arpent.

Figure 3.—Showing fresh weight of millable canes and green tops and the mean length of millable canes throughout the season.

Figure 4.—Showing increments in the mean length, fresh weight, dry weight, total sugars and water in the millable canes during the season, all except length expressed in tons per arpent.

Figure 5.—Showing the total Nitrogen contained in the millable canes, green tops and trash during the season, expressed on a per arpent basis.

Figure 6.—Showing similar data for P_2O_5 .

Figure 7.—Showing similar data for K_2O .

Figure 8.—Showing points for nutritional equilibrium obtained in the present experiments. For comparison, the points obtained for optimum nutrition by the Chemical Division of the Sugarcane Research Station and by investigators in Hawaii are included. The position of the points in the ratoons investigated suggests that there was a slight nitrogen deficiency.

Fig 2.

Composition of M 134/32 Ratoon Crop (Dry Weight)

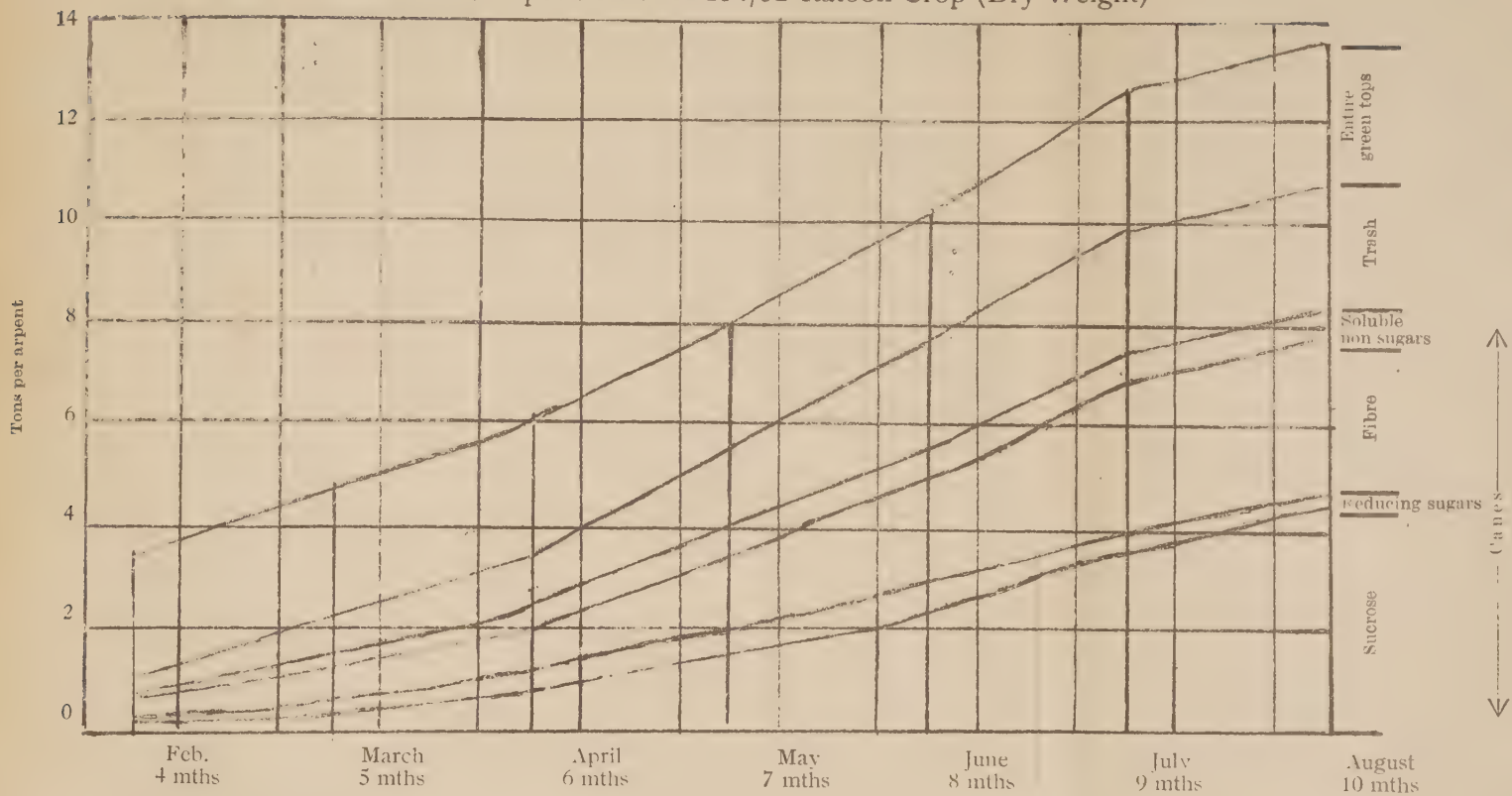


Fig 4

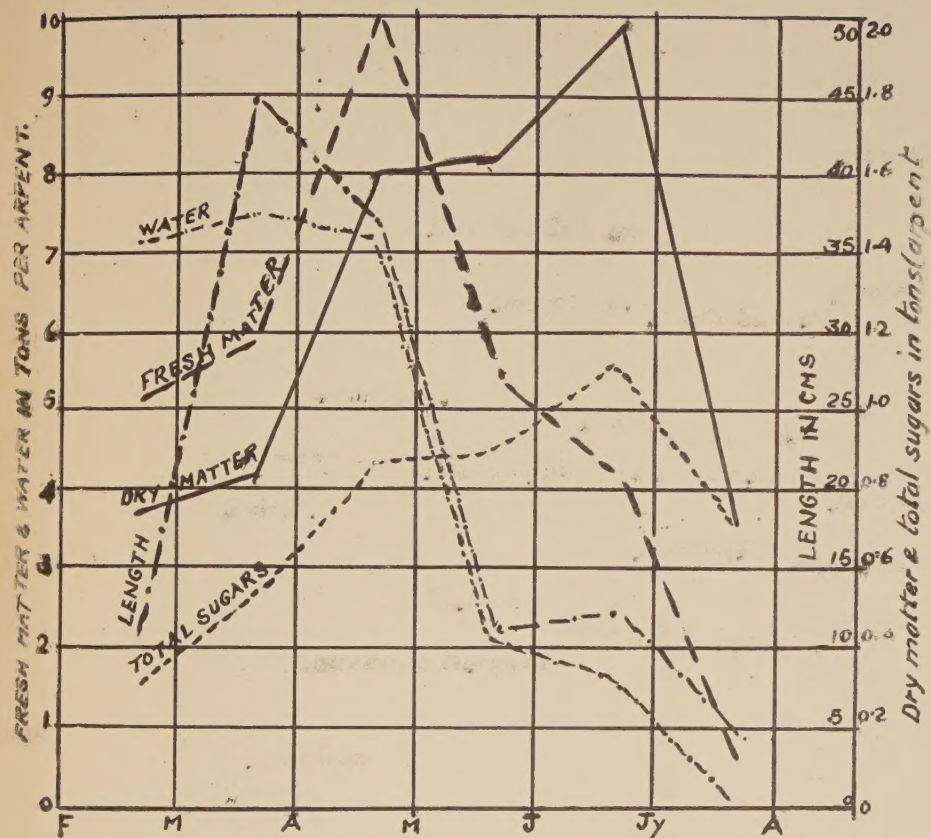


Fig 3

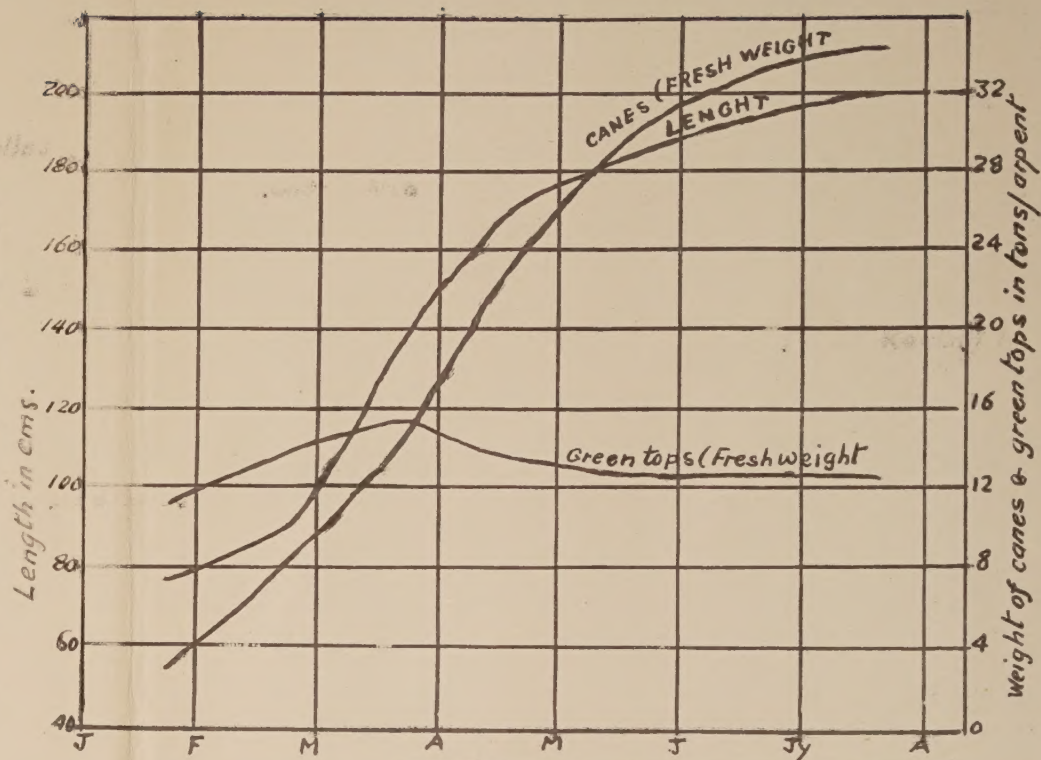


Fig 5

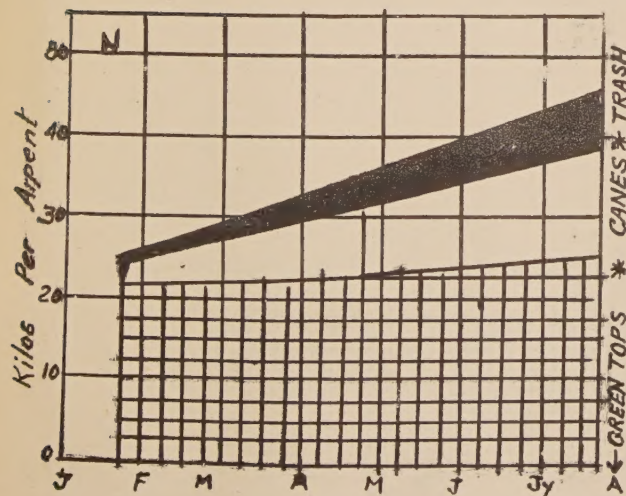


Fig 6.

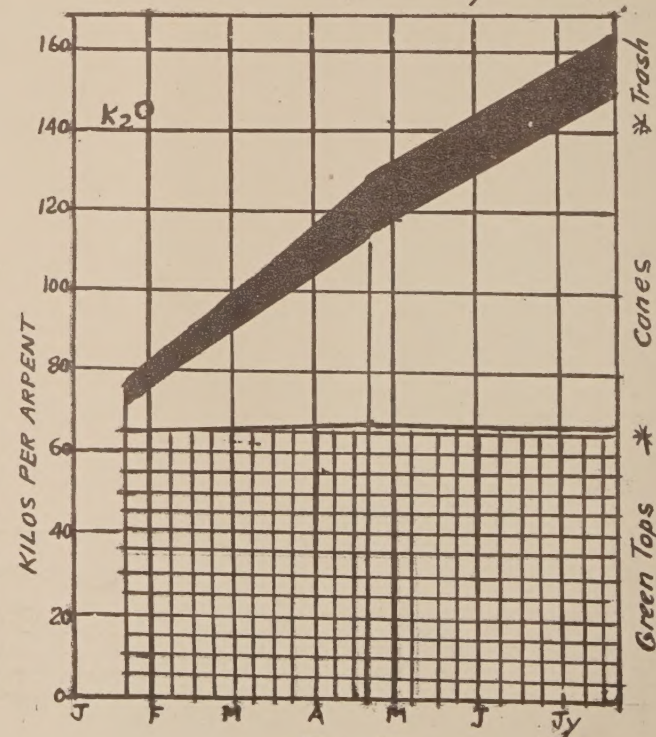
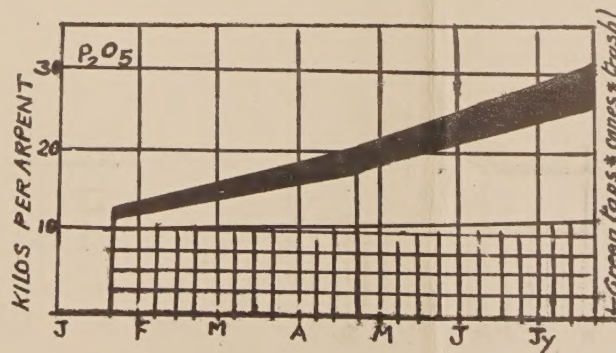


Fig 7

Fig. 8.

